



Social LCA in progress

4th SocSem

Pre-proceedings

**4th International
Seminar in Social LCA**

Montpellier, France
November 19-21, 2014

Collection FruiTrop Thema

Editors: Catherine Macombe, Denis Loeillet

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Collection FruiTrop Thema:

Social LCAs — Socio-economic effects in value chains (2013)

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Introduction

Since assessing the social effects associated with the life cycles of products and services first entered the research agenda, two complementary approaches have been developed.

The first seeks to explore the social aspects of the behaviour of the companies involved in the life cycle, in order to help them to meet certain standards. The objective of the second approach is to anticipate the social consequences of changes to be brought about in life cycles. By analogy with eco-innovation, the latter case may be called “socio-innovation”.

Should these two approaches concern different decision-makers? Should the context dictate the approach to be implemented? These hypotheses need to be explored.

This, the fourth international seminar on social LCA, will provide a forum for communicating and discussing recent progress both in evaluating the social behaviour of companies and in assessing the social consequences of changes (whether caused by environmental, social or other concerns). The intention is to focus in particular on social effects linked with environmental impacts, in the framework of life-cycles.

This structure brings together, in the form of pre-proceedings, all the contributions received following on from the Call. Furthermore, the presentations and debates which took place at the 4th SocSem will be available on the seminar website at the address: **<http://social-lca.cirad.fr/>**

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Preface

Pr. Roland Clift

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Social life cycle assessment: what are we trying to do?

The body of work set out in these proceedings reveals the range of approaches currently being explored to elucidate the social benefits and impacts of supply chains which provide services and products. However, this wide range underlines the point that the social Life Cycle Assessment (sLCA) community has yet to agree on the purpose and objectives of sLCA, much less found anything resembling an agreed approach and methodology. Therefore, rather than trying to give an overview of the current state of

sLCA, this brief introduction presents some thoughts on why a common purpose has yet to emerge and how such a purpose might be developed, addressing questions such as “How close should social LCA be to environmental LCA?”. Furthermore, bearing in mind that tools like LCA are intended for functional purposes not just for research, they must be designed with the user in mind; “What are we trying to do anyway?” is a relevant question. Parallel to environmental LCA (eLCA), the purpose of sLCA is to enable design of products and supply chains with improved social performance. However, behind that statement lie a number of conceptual and practical problems.

System Approaches to Sustainability

The concept of sustainability is commonly viewed as having three groups of components: techno-economic; environmental or ecological; and societal or social (e.g. Mitchell et al. 2004; Blewitt, 2008). It is also well established that the principles which comprise sustainability must be applied at a system level (e.g. Clayton and Radcliffe, 1996). Amongst the system-level analytical tools for assessing sustainability and guiding sustainable development, LCA is characterised by its focus on the supply chains delivering particular goods and services. Application of life cycle thinking to the techno-economic and environmental aspects of supply chains is well developed and the two facets are sometimes considered together, for example through the use of eco-metrics (e.g. Biswas et al., 1998; Clift, 2003; Prior et al., 2012).

Attention to the societal aspects of supply chains has been slower to enter the LCA arena. Following the proposition that life cycle sustainability assessment must include the third component, the first efforts to develop social life cycle assessment were directed at finding ways to include social impacts which parallel environmental LCA, for example using impact categories and indicators (e.g. Jørgensen et al., 2008; Dreyer et al., 2010). The UNEP guidelines on sLCA (Benoit and Mazijn, 2009) embody this approach, although they are “still very much in the developmental phase” (Paragahawewa et al., 2009). However, the social consequences of supply chains are qualitatively different from their environmental impacts, leading to the question of whether it is really appropriate to model social LCA on environmental LCA.

Environmental LCA is a scientifically-based analysis but is not a conventional application of the ‘normal science’ approach (in the sense defined by Ravetz, e.g. 1993) because its predictions are not amenable to Popperian empirical testing. Rather, eLCA has features in common with Risk Assessment (which was one of the original building blocks of LCA) and economic modelling (which also underpins the eco-metrics approach): eLCA uses the best understanding and models currently available to estimate expected outcomes but with no expectation that the predictions can be validated. This applies to mid-point impacts (i.e. contributions to pre-defined impact categories such as global climate change) and even more strongly to end-points (i.e. the human and economic consequences of the environmental impacts). The inherent

uncertainties position eLCA as a form of 'post-normal science' (Ravetz, 1993): a tool to support managerial and policy decisions rather than for scientific analysis. Thus any attempt to assess actual outcomes in social LCA (see below) sets sLCA apart from eLCA.

Social 'Good' and 'Bads'

There are also fundamental differences between sLCA and eLCA in the way the supply chain is perceived and therefore in the way the assessment is framed. Environmental LCA frames the assessment in terms of 'bads', i.e. the resource inputs and environmental impacts incurred in delivering a product or service. By contrast, sLCA is developing beyond merely detecting social 'bads' in supply chains. Supply chains can be seen not just as a one-way flows of resources from supplier to consumer, leaving impacts in their wake, but as channels by which benefits can flow back from the 'consumer' (of food or land use, for example) to the other agents in the chain. This perspective is essential in examining the meaning and interpretation of 'sustainable production and consumption' (Clift et al., 2013). It is exemplified by the international Fair Trade movement.

Adapting social LCA (or life cycle sustainability analysis) to this view of supply systems represents a methodological challenge going beyond the issues of system modelling. Urban food cultivation, an activity which has attracted academic attention in recent years, provides an example. At least in the 'global North', urban cultivation has little significance for nutrition or food security, primarily because the quantities of food which can be produced are nugatory by comparison with consumption (Martin et al., 2014) but nevertheless provides social benefits which are felt mainly at local level, rather than distributed along a supply chain, and which constitute the drivers for the activity. The common activity is a basis for development of social capital. It is questionable whether the benefits or relative disadvantages of urban cultivation can be captured by an approach based in LCA as currently conceived.

Social Impact Assessment

An alternative approach is to base sLCA on Social Impact Assessment (SIA), in much the same way as environmental LCA derives from Risk Assessment. Figure 1, based on Epstein and Yuthas (2014), shows a 'logic model' (also known as an 'impact chain' or 'results chain') used in planning and assessing a programme whose objectives include social change. The five components of the logic model are:

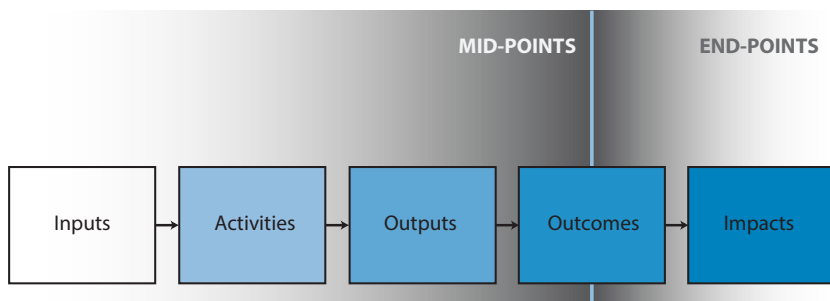


Figure 1: Basic logic model for Social Impact Assessment (after Epstein and Yuthas, 2014) with mid-points and end-points for Environmental LCA.

- Inputs including the resources available to and constraints on the programme;
- Activities: the processes, events and actions to be undertaken to complete the programme;
- Outputs: the deliverables from the programme;
- Outcomes: the direct effects on the population targeted by the programme;
- Impacts: the ultimate goal of the programme: “systematic and fundamental progress on a social issue” (Epstein and Yuthas, 2014); impacts should be included in the logic model even if there is no obvious way to measure them.

The logic model in Figure 1 reveals both the common ground and the differences between the methodologies of environmental and social LCA. If the word “programme” is replaced by “supply chain” or “life cycle”, the parallels between the components of the logic chain and the phases of eLCA are striking. Mid- and end-point impacts in eLCA can be positioned in the impact chain as shown. However, these parallels apply to the structure of the analysis, not to its execution: whereas, as noted above, eLCA is predictive and not verifiable, the logic model is used in SIA serves to help define the outcomes and impacts which should be measured directly. Identification of possible “social hot-spots” (e.g. Benoît-Norris et al., 2012) can help to identify the outcomes and impacts to be prioritised for attention but should not fully substitute for direct observation. As Jørgensen et al. (2008) pointed out for sLCA, “it is important to remember that the quality of site specific data is very dependent on the auditing approach and, therefore, not necessarily of high accuracy, and that generic data might be designed to take into account the location, sector, size and maybe ownership of a company and thereby in some cases give a reasonable impression of the social impacts that can be expected from the company performing the assessed process”. This suggests a further analogy between eLCA on the one hand and SIA on the other: analysis of “hot-spots” can identify where primary data are essential while secondary average or generic data can be used elsewhere.

It is tempting to pursue the analogy between eLCA and SIA further: for example, planned direct outcomes of a programme might be treated in the same qualitative way as impacts in an attributional eLCA, whereas indirect impacts – improvements in social practices inspired but not directly caused by the programme – might be treated by consequential analysis. However, it is probably advisable to leave the comparisons at this point: they are close enough to suggest that there will be value in developing social Life Cycle Assessment by applying ideas from Social Impact Assessment rather than trying to force sLCA into the mould of environmental LCA.

Conclusions

Social Life Cycle Assessment has a number of features which make it different from environmental LCA, of which the most fundamental is that eLCA is predictive and not amenable to empirical verification whereas sLCA relies on observation (which may include qualitative observation) of outcomes and impacts. Aspects of Social Impact Assessment might be used as a basis for developing sLCA, in much the way that Risk Assessment (RA) guided the development of eLCA. Analogies can be identified between the structures of RA and eLCA, although the two forms of assessment differ in execution. Social LCA is more likely to develop as a useful tool if it is not forced into the mould of environmental LCA. More fundamental examination of the purpose of sLCA is needed, preparatory to exploring how this purpose may be met – but that is precisely the purpose of this conference.

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Session 1

Panorama of Social LCA

Méthodes d'évaluation multicritère des systèmes agricoles et ACV sociale, quelle complémentarité ?

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1. Contexte et problématique

Les évolutions des pratiques agricoles et des systèmes alimentaires telles que l'intensification des cultures, la dessaisonalisation des productions, ou encore l'extension des circuits de distribution ont accru les pressions sur les ressources et l'environnement (pollutions diverses, consommation de ressources). Parallèlement, les contraintes pesant sur le secteur agricole se renforcent. La compétition pour l'usage des terres s'accroît, la raréfaction et l'altération de la qualité des ressources (eau, énergie, biodiversité) imposent de repenser les pratiques. Le renforcement des exigences sociétales conduit à de nouvelles réglementations et labélisations qui conditionnent de plus en plus les modes de production (ex : restriction des produits phytopharmaceutiques autorisés) et l'accès aux marchés (ex : Globalgap). Or l'agriculture fait face à un défi majeur, parvenir à nourrir 9 milliards d'individus à l'horizon 2050. Ceci implique une progression de la production alimentaire globale de 70% entre 2005 et 2050, avec par exemple une augmentation de près d'1 milliard de tonnes de céréales et de plus de 200 millions de tonnes pour la production de viande (FAO 2009). Ces éléments mettent ainsi en évidence l'importance de la problématique du développement durable au sein des systèmes agricoles. Ils encouragent les différents acteurs à évaluer les systèmes de production, à identifier les plus performants ou à en élaborer de nouveaux au service d'un développement plus durable (Craheix et al. 2012). Depuis une quinzaine d'années, de nombreuses méthodes d'évaluation des systèmes de production agricole ont été mises au point. Beaucoup d'entre elles ont mis l'accent sur la dimension environnementale, telles que INDIGO® (INRA Colmar), DIALECTE (Solagro), DIAGE (FRCA Centre). Ces méthodes reposent sur des indicateurs évaluant les effets directs au champ ou à l'exploitation (Bockstaller et al. 2013). Elles ont pour objectif le management environnemental des exploitations agricoles (Bockstaller et al. 2006). L'ACV environnementale se différencie de ces méthodes d'évaluation agri-environnementale de par sa capacité à évaluer les impacts environnementaux d'un produit tout au long de son cycle de vie, à comparer différents scénarios et à révéler les transferts de pollution. Néanmoins, certaines variables sont encore mal appréhendées, notamment la biodiversité et les produits phytosanitaires (Bockstaller et al. 2006). De plus, si l'ACV permet de comparer des systèmes très différents (systèmes herbagers vs système maïs-soja,

biologique vs conventionnel), elle n'est pas suffisamment discriminante pour des systèmes assez proches, du fait des incertitudes (Bockstaller et al. 2013). Aussi, il existe une certaine complémentarité entre l'ACV et les autres méthodes d'évaluation multicritère. Si le périmètre de l'étude le permet, des approches combinées peuvent enrichir les résultats de l'évaluation et offrir des analyses et des conseils agronomiques approfondis. Le développement durable impliquant des considérations plus larges que les seuls aspects environnementaux, des travaux ont progressivement intégré les autres aspects de la problématique dans l'évaluation des systèmes agricoles (ex : Arbre, IDEA, RISE, SAFE, EVAD, MASC, SYSTERRE®, DEXiPM, etc.). Ces initiatives sont relativement nombreuses et reposent elles aussi sur l'évaluation d'indicateurs. Elles bénéficient d'une reconnaissance auprès des acteurs du monde agricole français, étant développées et utilisées par les instituts techniques, les chambres d'agriculture, les instituts de recherche et de formation, ou encore les professionnels eux-mêmes. Il est donc intéressant de voir dans quelle mesure ces travaux peuvent nourrir les travaux en ACV sociale. Dans cette communication, il est proposé de s'intéresser à la potentielle complémentarité de ces approches avec l'ACV sociale. Dans une première partie, nous présentons les principales méthodes d'évaluation multicritère faisant référence en France. Dans une seconde partie, nous analysons les apports potentiels de ces méthodes et les points de divergence, plus particulièrement sur le plan des indicateurs sociaux et économiques, de l'unité fonctionnelle et du périmètre d'évaluation.

2. Matériel et méthodes

Six méthodes françaises d'évaluation multicritère appliquées aux systèmes agricoles ont fait l'objet d'une analyse approfondie. Le choix s'est fondé sur deux paramètres : i) les dimensions du développement durable considérées, afin de couvrir les aspects sociaux et économiques, ii) la reconnaissance par les acteurs du monde agricole, pour garantir leur légitimité. Les méthodes suivantes ont été considérées :

- le Diagnostic Agri-Environnemental, Social et Economique (DAESE) (Guillaumin et al. 2007),
- DEXiPM (Messéan et al. 2010),
- le guide EVAD (Rey-Valette et al. 2008),
- IDEA (Vilain 2008),
- MASC 2.0 (Craheix et al. 2012),
- et le Diagnostic durabilité du RAD (Réseau Agriculture Durable 2010).

Le tableau 1 rend compte des caractéristiques principales de chaque méthode.

Elles sont reconnues par les acteurs du monde agricole dans la mesure où elles sont élaborées et appliquées soit par la recherche (EVAD, MASC 2.0, DEXiPM), les acteurs du développement agricole tels que les chambres d'agriculture et les instituts techniques (DAESE) ou encore les professionnels/agriculteurs (Diagnostic de durabilité du RAD).

Elles ont été développées à partir et pour différentes cultures agricoles (grandes cultures, production laitière, aquaculture, élevage, viticulture). Elles s'appliquent principalement à l'échelle de l'exploitation. Seuls EVAD et MASC 2.0 proposent des indicateurs à l'échelle de la parcelle, du système de culture, de la filière et du territoire. Chaque méthode retient les trois dimensions classiques du développement durable (environnement, social, économique). EVAD considère une quatrième dimension institutionnelle. Elles sont toutes basées sur des systèmes d'indicateurs et reposent sur une logique d'emboîtement hiérarchique qui permet de relier les indicateurs à des principes généraux (Rey-Valette et al. 2008). Ainsi les dimensions (ou échelles/axes) sont subdivisées en critères (ou principes/composantes), regroupant une série d'indicateurs, eux-mêmes constitués d'un ou plusieurs items. MASC 2.0 et DEXiPM sont mis en œuvre avec le logiciel d'aide à la décision qualitatif DEXi (Bohanec 2011) et reposent ainsi sur des arbres de décisions dont l'arborescence comprend deux types de critères, agrégés (nœuds de l'arbre) et basiques (feuilles de l'arbre).

Le choix des indicateurs sociaux et économiques constituant ces référentiels s'est fait à partir des cadres existants comme ceux de l'OCDE, de l'Union Européenne, du Global Reporting Initiative ou encore du RICA (DEXiPM, IDEA, MASC 2.0), ou alors en co-construction avec les acteurs (EVAD, DAESE, RAD). Les indicateurs sociaux et économiques évalués diffèrent d'une méthode à l'autre mais certains critères font consensus. Sur un plan humain, toutes les méthodes prennent en compte la contribution à l'emploi (nombre, type d'emploi) et les conditions de travail (pénibilité, sécurité, charge de travail, heures, stress, conflits). La formation/éducation (formation professionnelle, accès à l'information via des revues techniques, interaction recherche/profession) est aussi un thème important. Il est intéressant de noter que des critères récurrents dans les référentiels sociaux tels que la parité, la syndicalisation et les accidents du travail ne sont pratiquement pas considérés dans ces méthodes. Sur un plan social, les critères relatifs à la qualité des produits (mycotoxine, pesticide, hygiène), à l'entretien des paysages (bâtiments, structures paysagères, chemins), à la participation à des réseaux (association professionnelle, CUMA, syndicat) et aux interactions avec le reste de la société (portes ouvertes, ferme pédagogique, insertion) sont communs à la plupart des méthodes. Sur un plan technico-économique, les critères efficacité / rentabilité / viabilité économique, sensibilité aux aides et autonomie / dépendance (aléas naturels, risques biologiques, fournisseurs) sont communs à toutes les méthodes. Les critères de vulnérabilité commerciale, spécialisation (diversité des revenus), transmissibilité et contribution à l'économie locale sont aussi particulièrement importants. En revanche, la rémunération du travail n'est pas un critère prédominant. Seules trois méthodes le considèrent (DAESE, RAD, EVAD). EVAD propose des critères originaux par rapport aux autres méthodes, relatifs aux interactions avec l'Etat et les services publics (accès, impôts / subventions, corruption), à l'accès aux informations (censure, journaux professionnels, recherche publique) ou aux dispositifs de contrôle (infractions).

Les principes d'évaluation des critères dépendent du type d'indicateur et de leur mesure ; certains sont quantitatifs, beaucoup sont qualitatifs. EVAD, IDEA et RAD convertissent les valeurs des variables en score (ou note, point) grâce à des barèmes

(ou valeur de référence). L'agrégation repose ensuite soit sur une moyenne des valeurs des indicateurs (EVAD), soit sur une somme (IDEA). Le RAD ne fait pas d'agrégation mais propose un tableau de bord. C'est également le cas de DAESE qui présente les valeurs brutes des variables sans aucune transformation, elles sont uniquement comparées à la moyenne des autres exploitations agricoles. MASC 2.0 et DEXiPM proposent des modes de calcul particuliers pour chaque indicateur, qu'elles convertissent en classes qualitatives du type « faible », « moyen », « élevé ». L'agrégation se fait grâce à des fonctions d'utilité de type « si, alors » établies par des experts. Les critères agrégés sont aussi présentés via un tableau de bord.

3. Résultats : convergences et divergences

L'analyse de la complémentarité des approches se réfère aux trois caractéristiques principales de l'ACV sociale.

Le premier point concerne l'évaluation des impacts sociaux et la nature des indicateurs. Les méthodes analysées utilisent, selon la typologie de Bockstaller et al. (2012), des indicateurs « simples » ou de moyen (ex : heures de travail), et des indicateurs d'effets, basés sur des mesures de terrain (surcharge de travail, stress ressenti par les agriculteurs, pesticides dans des bougies poreuses). Les indicateurs du premier type sont basés sur une variable ou une combinaison mathématique de variables, sous forme de ratio ou de soldes. Ils rendent compte des pratiques (sociales, économiques) mais ils intègrent faiblement les processus. Ils ne renseignent donc pas les effets ou les changements affectant les individus ou la société. Par exemple, l'accueil touristique ou les types de substances actives utilisées (indicateurs simples) sont des conditions à la création de valeur ajoutée ou de pollutions. Les indicateurs du second type reposant sur des mesures de terrain intègrent les processus et peuvent rendre compte d'effets ou d'impacts ressentis (sur la santé, le bien-être), mais ils sont généralement lourds à mettre en œuvre et n'ont pas de réelle puissance explicative. A la différence de ces deux types d'indicateurs, les indicateurs environnementaux de la méthode Indigo®, utilisés dans MASC 2.0, et de ceux simplifiés de DEXiPM, sont prédictifs. Ils permettent ainsi d'explicitier les causes des résultats évalués ou d'évaluer des systèmes simulés. Cependant, de tels indicateurs prédictifs ne se retrouvent quasiment pas pour la dimension sociale. Or l'objet de l'ACV sociale est d'évaluer et de prévoir les impacts sociaux d'un produit tout au long de son cycle de vie.

Le deuxième point a trait à la capacité à révéler les transferts d'impacts sociaux. Dans les méthodes analysées, les résultats de l'évaluation sont souvent implicitement rapportés à l'exploitation en termes d'unité spatiale et ne sont pas exprimés en termes de fonction remplie ou de service rendu, aucune unité fonctionnelle n'étant définie. Il est donc difficile de procéder à des comparaisons de scénarios sur des bases similaires, puisque chaque exploitation peut avoir un profil d'activité très différent (valorisation des co-produits et sous-produits, diversification agricole / monoculture, production intensive / extensive, etc.) et des interactions sociales variables (fournisseurs, clients,

sous-traitants, population locale, employés, administration, etc.). Or la comparaison de scénarios entre deux périodes de temps, deux entités distinctes ou deux systèmes de production permet d'isoler les effets d'aubaine et le contexte extérieur (« bruit de fond ») et ainsi de mettre en évidence les transferts d'impacts (Feschet 2014). La valeur ajoutée de l'ACV réside justement dans sa capacité à identifier les variations d'impacts entre un scénario A et un scénario B, entre catégories d'impact ou entre étapes du cycle de vie. Cela permet à un décideur de l'aider dans ses choix de systèmes (technologie, localisation, organisation du travail) et cela permet aussi d'identifier les possibilités réelles d'amélioration du cycle de vie en s'assurant que l'amélioration d'une catégorie d'impact ne se fait pas au détriment d'une autre.

Enfin, le dernier point porte sur l'identification des effets induits et indirects. Dans les méthodes analysées, le périmètre de l'évaluation et les trois dimensions qui le composent (temps, espace, acteurs affectés) (Macombe et Lagarde 2013) ne sont pas explicitement définis. Spatialement, il est le plus souvent restreint à l'exploitation. Les acteurs en dehors de la sphère d'influence directe de l'exploitation ne sont pas considérés. C'est notamment le cas des sous-traitants / fournisseurs / clients ou des activités complémentaires voire concurrentes qui peuvent être affectés par le fonctionnement ou des changements opérés par l'exploitation. Or la légitimité de l'ACV sociale se joue sur sa capacité à tenir compte de ces effets indirects, tels qu'une expropriation ou la perte de débouchés commerciaux.

Néanmoins, malgré ces divergences importantes, les méthodes analysées présentent des intérêts évidents. La diversité des indicateurs est riche sur le plan des informations qui les composent (source, mode de calcul, valeurs de référence, classes) et le traitement qu'il en est proposé (modèle de décision multicritère, logique floue, etc.). De plus, pour un certain nombre de méthodes, les indicateurs ne relèvent pas de l'évaluation de performances sociales (ex : droit de grève ou droit de se syndiquer), comme c'est le cas dans les démarches de RSE, mais d'effets ou de conditions préalables aux effets (ex : nombre de conflits sociaux pour exprimer le climat social). Ils s'inscrivent dans la chaîne de causalité (inventaire, indicateur midpoint, indicateur endpoint) qui fonde l'ACV, et s'apparentent aux indicateurs proposés par l'ACV sociale des capacités (Garrabé et Feschet 2013). Par ailleurs, bien que non formalisé en tant que tel dans toutes les méthodes, un effort est porté sur la prise en compte des différents acteurs affectés : employés (ex : conditions de travail, rémunération, qualité de l'emploi), société locale (ex : économie locale, interactions sociales), administrations / institutions (ex : impôts, aides, corruption), partenaires économiques (ex : dépendance), société dans son ensemble (ex : qualité des produits). Ces éléments peuvent nourrir la réflexion sur les différents impacts et relations de cause à effet à développer.

Tableau 1 : Caractéristiques des méthodes d'évaluation multicritère comparées

Nom de la méthode	Concepteurs	Culture	Échelle	Critères principaux	Nombre d'indicateurs
DAESE-OTPA	Institut de l'Élevage, Agro-transfert Picardie, Chambre d'Agriculture de Picardie	Grandes cultures, production laitière, élevage, viticulture	Exploitation	19	120
DEXiPM	INRA	Grandes cultures	Exploitation	8	61
EVAD	UM1, INRA, CIRAD, IRD, IFREMER	Aquaculture	Exploitation, secteur/territoire	13	230
IDEA	Bergerie nationale, INRA, ENSAIA, Cemagref	Grandes cultures	Exploitation	10	42
MASC 2.0	INRA	Grandes cultures	Parcelle ou système de culture	8	39
Diagnostic de durabilité - RAD	Réseau agriculture durable, CIVAM	Production laitière	Exploitation	18	34
Nom de la méthode	Dimensions de la durabilité	Principes d'évaluation (mesure, agrégation, pondération)			
DAESE-OTPA	Economique social environnemental	Indicateurs de Pression et de Réponse (DSPIR, OCDE). Pas d'agrégation, tableau de bord.			
DEXiPM	Economique social environnemental	Classes qualitatives du type « faible », « moyen », « élevé » pour chaque critère. Agrégation via DEXi (arbre de décision).			
EVAD	Economique social institutionnel environnemental	Variables quantitatives converties en classes et en modalités qualitatives, un barème de durabilité permet d'attribuer un score à l'indicateur. Agrégation : moyenne des valeurs des indicateurs.			
IDEA	Economique social environnemental	Indicateur composé d'items élémentaires, chaque item a une note, chaque indicateur a une note. Agrégation : somme des notes.			
MASC 2.0	Economique social environnemental	Classes qualitatives du type « faible », « moyen », « élevé » pour chaque critère. Agrégation via DEXi (arbre de décision).			
Diagnostic de durabilité - RAD	Economique social environnemental	Un ou plusieurs indicateurs par critère. Un « barème » (valeur de référence) permet d'attribuer les « points » (valeur) à l'indicateur. Pas d'agrégation, représentation en étoile.			

4. Discussion et perspectives

Les méthodes d'évaluation multicritère des systèmes agricoles analysées dans cette communication ne sont pas compatibles en tant que telles avec l'ACV sociale. Mais certains éléments peuvent contribuer aux développements méthodologiques, en particulier certains indicateurs de moyen ou d'impact ressenti. De plus, grâce à la proximité et la connaissance du secteur agricole, voire parfois la co-construction des référentiels avec les acteurs, ces méthodes permettent d'identifier ce qui compte sur les plans humains, sociaux et économiques dans les systèmes agricoles français. Aussi, dans l'attente d'avoir une méthode d'ACV sociale qui évalue un ensemble d'impacts sociaux en agriculture, comparable à l'ACV environnementale, ces méthodes d'évaluation multicritère, avec quelques améliorations, peuvent constituer une alternative intéressante.

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Meta-analysis of SLCA: where are we and where are we headed?

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Social Life Cycle Assessment (SLCA) has first been developed to complement Environmental Life Cycle Assessment (ELCA) with social aspects (UNEP/SETAC, 2009). However, whether it has allowed for the integration of social aspects into the ELCA methodology, or for the consideration of social aspect into decisions and applications where ELCA is traditionally used is a question still in search for an answer (Parent et al., 2013). What makes SLCA a part of Life Cycle Assessment (LCA) is still not clear despite many years of theoretical reflection and practical application. In order to feed into this reflection, a broad selection of theoretical texts pertaining to or relying upon SLCA have been selected and reviewed. Our goal has been to capture explicit or implicit methodological features that closely fit into the ELCA framework or other types of methodological features, and whether or not they strive to answer questions which ELCA usually addresses. In other words, this review offers a portrait of today's SLCA which – we hope – will provide insight into the question of “what are its potential trajectories?”. In order to do so, each theoretical text or case study was assessed with regards to its intended application; the unit used to described the product system (what would be, in ELCA, the unit process); the elements that vary inside a system or between systems (the elementary flux); the method used to assess if the observed variation potentially intensifies a social impact or, on the contrary, if it reduces that potential or creates benefits (the characterization factors); the areas of protection which – sometimes implicitly – is suggested; and, finally, the boundaries of the system assessed. The evolution of emphasis upon these last characteristics through time was also analyzed in order to offer an appreciation of what might the future orientation of SLCA be. This work is completed in the context of a working group involving consultants from Groupe AGÉCO and researchers from the inter-university research centre the CIRAIG.

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Social issues in classical and social LCA: from identification of overlaps to an integrated framework

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1. Context and scope

In order to come to an overall Life Cycle Sustainability Assessment (LCSA), it has been stated many times that classical (environmental) Life Cycle Assessment (LCA) should be extended with economic and social impact assessment like Life Cycle Costing (LCC) and Social Life Cycle Assessment (SLCA). This methodological framework reflects the concept of sustainable development as defined in the Johannesburg World Summit on Sustainable Development (UN, 2002). Indeed, according to this definition the sustainability principle should integrate the three pillars of economy, environment and society, also referred as 3P approach: people, planet and prosperity. LCA has first emerged as a tool for environmental management, based on the compilation of physical exchanges in between the natural environment and the human/industrial environment (energy and materials) and the assessment of the environmental impacts directly attributable to a system throughout its life cycle.

The importance of understanding social aspects of supply chains and their cost and benefits for human societies have been increasingly recognized. SLCA and LCC methodologies are aimed at addressing these aspects, complementing the information provided by LCA on the environmental aspects. However, it is questionable whether LCA assesses the environmental impacts only, as stated in the ISO definition (ISO 14044, 2006), or if it already includes socio-economic aspects. This is particularly evident in the impact assessment of natural resources, based on the assumption that decreased availability of resources will damage human systems. Beyond scarcity, the security of supply of mineral raw materials has become a high-priority theme in the political agenda of many countries, especially those highly dependent on imports. The need of taking into account in LCA economic and geopolitical aspects that can reduce resource availability has been acknowledged (Schneider et al., 2011, Mancini et al. in press), and is debated if they should be accounted in LCA or in SLCA (Mancini et al., 2013).

Establishing clear domains between LCA and SLCA implies the definition of what we want to protect or promote using one methodology or the other. Traditionally, the three Areas of Protection (AoP) in environmental LCA are Human Health, Natural environment and Natural resources (EC - European Commission, 2011), but the inclusion of the AoP “Human Dignity and well-being” was proposed by Dreyer et al. (2006) to supplement the existing ones through SLCA. The Prosuite proposal for an integrated sustainability assessment framework to be used in LCA includes five impact categories: Human Health, Social Well-being, Prosperity, Natural Environment and Exhaustible Resources, broadening the scope of LCA to the three pillars of sustainability.

Impacts on human health due to physical exchanges in between the ecosphere and technosphere are typically accounted for in environmental LCA, in terms of Disability-adjusted life year (DALY) or quality-adjusted life-year (QALY). Human health is also accounted for in SLCA, but typically taking into account impacts on different stakeholders, often caused by socio-economic conditions, e.g. labor conditions. This suggests that there may be an overlap between Social and Environmental LCA: both target to quantify impacts on humans caused by a production and consumption cycle. At a second glance, the identification of this ‘overlap’ might be a source of rethinking social impacts; indeed, both environmental LCA and SLCA envisage the same AoP “Humans” (health, dignity, well-being) but starting from other causes. In this sense, further analysis might result in recognizing some complementarity instead of overlap.

Given the above picture, this paper aims at contributing to the scientific discussion on the scope and field of domain of LCA, in relation with the SLCA and LCC. This is done through: i) an analysis of the overlaps of contents among existing areas of protection ii) the proposal of a framework for the AoP ‘Humans’ based on the application of cause-effect mechanisms and the integration of bio-physical accounting with economic accounting in the assessment of production and consumption systems.

2. Analysis of the Areas of Protection and proposal of an integrated framework

While the AoP natural environment (also defined as “ecosystem quality” in the UNEP classification (UNEP/SETAC Life Cycle Initiative, 2011)) has a pure environmental focus, the inclusion of natural resources and human health in the environmental assessment is less straightforward. Natural resources, in particular, are at the edge of natural and anthropogenic systems, as they are extracted from the natural environment to feed the economic production systems. The impacts due to resource extraction and use are very different and depend on the life-cycle stage. At the cradle (i.e. before the resource use), resources extraction can negatively affect the functioning of ecosystems, therefore negatively impacting the natural environment. Moreover, availability issues can rise, especially for the non-renewable resources. The risk of resource depletion, and its future consequences on human wellbeing, is currently accounted in LCA

through the resource depletion impact category. Even though this issue is commonly included within the environmental assessment, the consequences of limited resource availability are likely to affect the human societies primarily. Resource scarcity can also result as a consequence of temporary disruptions in the supply chain. This aspect is closely related to the concept of “resource criticality”, and regards the risk of supply of raw materials due to geo-political reasons. In the criticality assessment socio-economic aspects like, e.g. governance of the producing countries, market concentration and import dependency are taken into account (EC - European Commission, 2014; Graedel et al., 2012). Resource criticality, even though not included in the mainstream practice, is starting to be considered in the (environmental) LC impact assessment methods. Despite of its socio-economic nature, the integration of this aspect in LCA appears to be much more feasible than in SLCA, due to the accounting in physical units and the compilation of mass flows inventory that is commonly practiced in LCA (Mancini et al., 2014). Other social aspects linked to resource supply chain can be captured in SLCA and they refer to, e.g., labor conditions, human rights violations and sharing benefits from resources extraction with local populations. These aspects are considered in this methodology also because they need the involvement of different stakeholder categories and the magnitude of the impact is expressed in terms of risk and working hours.

Human health is accounted in environmental LCA with the aim of quantifying the changes in both mortality and morbidity that are associated with goods or services and caused by various types of environmental stressors induced by ‘elementary flows’ at the ecosphere/technosphere interphase. According to Dreyer et al. (2006) SLCA should embrace a broader understanding of the human life, and not be limited to the life expectancy. Health is one of the three prerequisites for protecting human life, together with dignity (i.e. to live a decent life and enjoy respect and social membership) and basic needs fulfillment (i.e. the access to food, water, clothes, medical care, etc). Therefore, the AoP human health in LCA can be considered a sub-set of the wider area AoP ‘Humans’, including Human Health, Human Dignity and Well-being, the latter two more addressed in SLCA.

This brief analysis highlights that, in spite of the formal definition of environmental LCA, the methodology does not account environmental impacts only; the metrics used in the assessment (physical, economic, etc), seems to be the main criteria for the inclusion of an aspect in a methodology or in the other, rather than the nature of the impact itself. Some aspects like natural resources, however, are multifaceted and need a more holistic assessment.

3. Proposal for an integrated framework to cover social issues in (S)LCA

Classical environmental LCA is based on a life cycle inventory, i.e. listing all resources extracted from and emissions released into the environment. This physical exchange

between the environment and the human-industrial sphere is the starting point of so-called cause-and-effect chains that impact AoPs: the natural environment, natural resources and human health. However, human health and other impacts on humans are not only affected by this cause-and-effect chain that is initiated at the ecosphere/technosphere interphase. Indeed, Humans as a broadly defined AoP can be threatened by other causes within the human-industrial environment or technosphere.

So if one aims at a holistic analysis of impacts on Humans as AoP due to the life cycle of a product (including resource extraction, processing, design, manufacturing, retail, distribution, use, collection and re-use/recycling/energy recovery/disposal), we may propose two types of cause-and-effect chains that impact the AoP Humans. First, there is the cause-and-effect chain typically considered in environmental LCA, see Figure 1 at left hand side: it starts from flows in between the ecosphere and technosphere. After their inventory, they are translated into impacts on the classical AoPs. With respect to Humans, the considered health effects can be local, short term, global and/or long term.

Secondly, the aforementioned set of life cycle stages of a product does not only result in physical ecosphere/technosphere exchanges, but also in a number of economic exchanges within the human-industrial sphere that impact humans as well, see Figure 1 right hand side. Over the life cycle, we identify two basic economic exchanges that can be identified as a starting point of a cause-and-effect chain and that are situated within the technosphere. First, there is the exchange “labor for income”, to be situated in the production phases: humans receive money in turn for their labor. This first exchange can be the starting point of a first set of cause-and-effect chains that impact humans. On one hand the labor conditions can cause several effects on humans as typically recognized in social LCA (child labor, excessive working hours ...). On the other hand this exchange provides income so that the employee or employer receives income he can spend to meet his needs. This latter impact is a positive impact; positive impacts are rarely considered in a cause-and-effect context in LCA.

A second economic exchange is “expenditure for products and services”: humans spend money to acquire products and services. This exchange is clearly at the use phase in the life cycle. Again, the exchange can be seen as the starting point of two kinds of cause-and-effect chains. First it results in exposure to products and services that may impact health or even safety of humans when they are not properly manufactured. Second and maybe more importantly: the acquisition of products and services helps in meeting needs of people, hence in a positive impact.

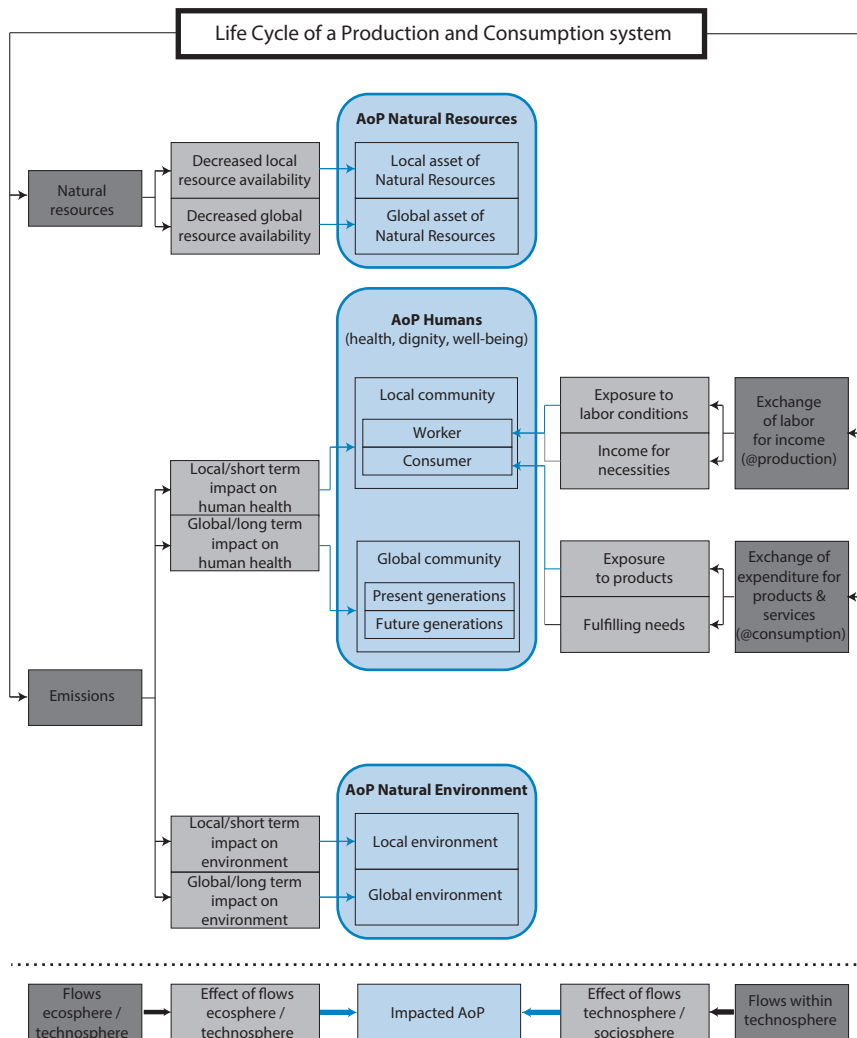


Figure 1: Proposal for an integrated framework to assess impacts on Humans in (S)LCA as AoP next to other AoPs as a result of a production and consumption system (top), through effects as a result of two types of causes: (1) elementary flows as in classical environmental LCA (elementary flows in between ecosphere and technosphere) (left hand side); (2) economic flows within the technosphere (right hand side). Arrows represent negative impacts but positive ones (effect of income for necessities and fulfilling needs) as well.

In summary, the life cycle of a product results into both physical exchanges in between the ecosphere and the technosphere, and in economic exchanges within the technosphere. These exchanges result in four types of negative effects on the AoP Humans (health, dignity, well-being):

- Local/short term impacts on humans caused by emissions (impacts mainly on health)
- Global/long term impact on humans caused by emissions (impacts mainly on health)
- Impacts on humans caused by exposure to labor conditions (impacts mainly on health, safety, well-being)
- Impacts on humans caused by exposure to products (impacts mainly on health and safety)

Secondly, there are also positive impacts as a result of a product's life cycle to be recognized :

- Income for necessities for humans as a result of the labor offered into the product's life cycle (at production)
- Meeting of needs for humans as a result of the consumption of the product's use phase (at use)

4. Conclusions and perspectives

Social issues are part of both classical (environmental) LCA and SLCA. The aforementioned sections revealed that both aim at quantification of impacts on Humans as AoP, but typically as a result of other causes, ending in the conclusion that both frameworks are rather complementary, although with some overlapping. A holistic analysis of cause and effects chains that impact Humans as AoP have been proposed. This may be ground to a better integration of social and environmental LCA. A next step may be a quantification of impacts of both physical and economic nature in a similar way, ideally on the basis of a same unit. In a first phase, at least negative impacts may be considered. Basically, there is the possibility of the quantification of labor conditions in terms of QALYs (instead of risk hour equivalents) (Weidema, 2006). Even positive impacts have been approached in a similar way, e.g. the QALY concept is typically used in health economics to assess the benefit of the intake of medicines as product (Whitehead and Ali, 2010).

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Systematic review of Social-Life Cycle Assessment (S-LCA) case studies

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1. Context

Social Life Cycle Assessment (S-LCA), is a methodology standardised in 2009 with the emanation of the “Guidelines for Social Life Cycle Assessment of Products” by UNEP/SETAC. This methodology, although being not yet as widespread as other Life Cycle Thinking tools, is generating a growing interest, evidenced by an increasing number of related academic papers and case studies.

The concept of positive impacts arise in the field of Social Impact Assessment (SIA), for example Vanclay (2003), introduces concepts that stimulate a new vision of Impact Assessment (IA), not only seen as a mere methodology aiming at calculating negative impacts, but also assuming a positive connotation for a proactive and better development of outcomes.

The goal of this paper is to analyse the S-LCA case studies published between 2006 and 2014 in order to detect whether any positive impacts have been underlined along with the negative ones. To better understand this goal it is useful to define what a social impact is. A clear definition can be found on page 107 of the Guidelines and Principles for Social Impact Assessment (1994): “the consequences on human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organize themselves so as to meet their needs and generally cope as members of society.” Starting from this concept, it is possible to try to give a definition of what social positive impact is, and to better understand the purpose of the present study.

To better analyse the role of positive impacts in S-LCA, a questionnaire was edited and sent to all the authors of the case studies collected along with a number of experts in the S-LCA field.

2. Method

A systematic review of S-LCA case studies was implemented to conduct this paper.

The search engines used in this review were: Google Scholar, Scopus and the Discovery browser (by EBSCO Host) accessed from the University "G. d'Annunzio". The keywords used to conduct the research were the following: "Social Life Cycle Assessment" case study, SLCA case study, "Social LCA" case study, Social LCA case study, Societal LCA case study, "Societal LCA" case study, "Societal Life Cycle Assessment" case study, Societal Life Cycle Assessment case study, Social Life Cycle Assessment case study. The papers not pertinent to our research work and papers that were not S-LCA cases studies (including case studies in which social impacts are assessed, but not with the S-LCA methodology) were excluded. At the end of this first phase, 35 case studies were considered as relevant. A Summary Table was prepared to summarise them for the identification of the main trends.

3. Results and Discussion

Critical review

Using the keyword "case study" to perform the research, proved to be insufficient since most case studies are integrated in theoretical papers as an application or appendix.

Within the 35 case studies considered, apart from examining their goals, the following were identified: 4 papers on energy sources (3 on biofuels and 1 on diesel and petrol), 7 on Information and Communication Technologies, 7 on the agri-food sector and 5 on waste management. The remaining 12 papers can be classified as "Others" because of the diversity of the topics covered.

The analysis of the 35 identified papers showed that approximately 71% (25 of 35) of these were conducted in accordance with the UNEP/SETAC Guidelines, thus confirming the fact that these have had an essential influence (leverage) on the S-LCA research field.

Main methodological issues

Here some of the methodological matters described in ISO 14040 were analysed: Functional Unit (FU), System Boundary and Impact Assessment (IA) methods. Only 34% of the papers analysed took into consideration a numerical FU, whereas 51% considered a non-numerical FU (of the latter only 14% specified the reference flow). The remaining 14% did not state any FU (Figure 1).

Regarding the System Boundary, 40% of the analysed studies (Figure 1) considered the entire life cycle from “cradle to grave”, 20% of these assessed the life cycle of the product from “cradle to gate” while the 26% assessed it from “gate to gate” (e.g. between banana plantations and the port in Feschet et al. 2013). 9% of the authors did not specify the System Boundary considered in their work. Two papers were categorised as “Other” because of the particularity of the System Boundary considered: Macombe et al. 2013 considered “the national economy” and Paragahawewa et al. 2009 affirmed that “it is appropriate to focus on all socially significant impacts from both company and production specific activities as per ISO 14044 requirements for E-LCA”.

Regarding the IA phase, 68% of the analysed papers used an IA method in the field of the so-called Taskforce approach, 6% used DALY (Disability-Adjusted Life Year), 6% the Pathways approach, two papers (6% of the total) did not implement any IA and other two did not specify the IA method used. Three papers (8%) were included in the category “Other” in virtue of the peculiarities of the method used (Figure 1).

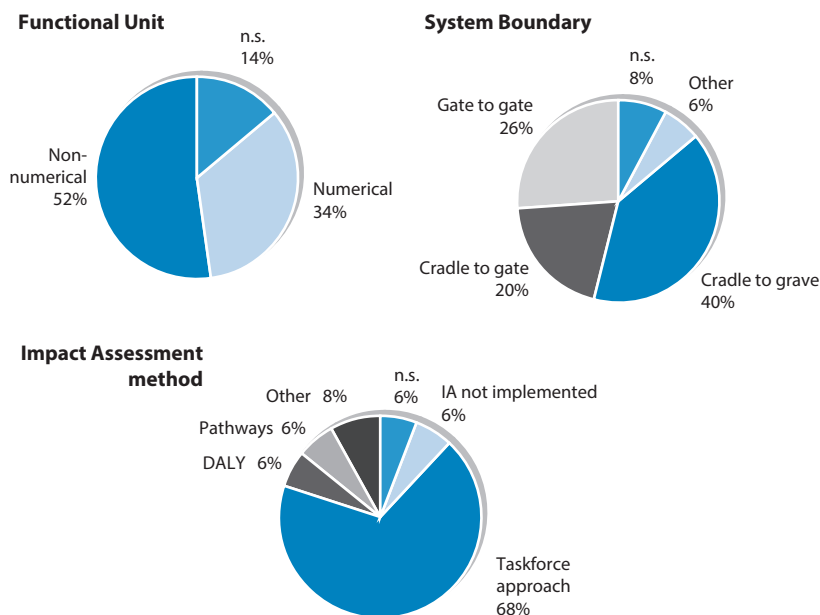


Figure 1: Percentage breakdown of the analysed papers according to the Functional Unit, System Boundary Impact Assessment method considered.

The tendency to propose different IA methods, by many authors, perhaps reveals a weakness in the methodology. In fact, in UNEP/SETAC Guidelines (2009) the impact assessment methodologies are considered as an open field and further developments of IA methods are greatly needed. To fill this gap an attempt was done by publishing a Handbook on Product Social Impact Assessment by Prè Sustainability in September 2014 (Roundtable for Product Social Metrics 2014).

Impact indicators

As regards the impact indicators, crucial to assess the various social issues of concern (subcategories), these are not specified in 10 out of 35 case studies (about 30% of the total).

The most considered stakeholder category is “Workers” (100%, i.e. 30 of 35 papers that explicitly took into account the stakeholder categories). This could mean that workers are considered by the authors, as the most impacted stakeholder category from a social point of view. The analysis of the papers has shown that some authors use, among social indicators, those elements that help to better characterise the context in which a company operates (although these are not present in the Guidelines). These elements are the characteristic indicators of a given sector which would have little meaning if considered within a different context. There are however, other indicators present in the Guidelines, but are considered less apt to the specific case study developed and therefore not taken into account.

Positive social impacts

In the already published literature regarding the analysis of positive impacts in S-LCA, references to this topic include: in Sanchez Ramirez et al. (2014, p.1515) the authors state that “(S-LCA) [...] enables us to assess the behaviour of organizations and to gain a better understanding of this behaviour and its development in relation to the various stakeholders.”. Furthermore, on page 50, the UNEP/SETAC Guidelines state that “[t]he ultimate objective for conducting a S-LCA is to promote improvement of social conditions and of the overall socio-economic performance of a product throughout its life cycle for all of its stakeholders. Achievement of minimum benchmarks or thresholds of performance is recognized by the methods, but so are positive impacts that go beyond compliance”. In these statements the growing attention attributed to positive social impacts is highlighted.

In more recent years, the theme of positive social impacts has been dealt with by authors such as Norris (2006) and Ekener-Petersen (2013). In the first paper, the author refers to “health impacts” (both positive and negative), introducing the concept of positive social impacts, although not having been examined in depth. The paper by Ekener-Petersen (2013, 12) aims “to examine different ways in which the methodology can be applied and to study methodologies for adopting an ethical perspective on how social impacts are distributed among stakeholders”, through the analysis of three

case studies and by taking into account both negative and positive impacts, therefore giving importance to the role of positive impacts. Norris (n.d.) also developed a new approach (called “Handprint accounting”) in which positive impacts can be directly compared with (and subtracted from) the negative ones.

The analysis of the papers shows that 37% of the case studies (13 of 35) do not explicitly identify any positive impact. The remaining 63% was divided per industrial sectors, as shown in Figure 2.

Percentage of consideration of positive impacts

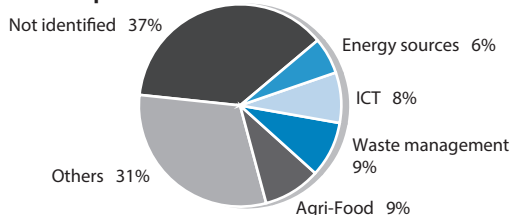


Figure 2: Percentage breakdown of the analysed papers according to the consideration of positive social impacts.

The analysis carried out showed that the utility of goods is identified as a positive impact in two papers (Baumann et al. 2013, Ekener-Petersen and Moberg 2013). The utility, in the economic language, is defined as the well-being that a given good or service is able to provide to a person as it is suitable to satisfy a desire or fulfil a need (Treccani 2012). It appears, therefore, somehow significant to consider the utility performed by the good during its use phase as a positive impact.

The concept of positive impacts, however, does not refer merely to the utility (benefit from its use), but in a broader sense, to the so called «win-win» situations¹, in which solutions that improve the condition of various stakeholders involved are identified.

In the paper Traverso et al. (2012) “all benefits (wage, holiday, undetermined contracts and so on) are considered as positive impacts”. This seems quite odd, as the case study focuses on Germany and Italy as a Geographical Area, where such benefits are provided by appropriate laws to protect workers. Therefore, this type of claim is also in contradiction with the definition of a positive impact (performance that go beyond compliance) given by the Guidelines.

¹ A win-win situation is defined as a situation in which all parties involved in the initiative have a benefit in terms of value created in their favour (Molteni 2007).

Another interesting consideration regarding positive impacts is made in the paper of Vinyes et al. (2013), where it is declared that “[n]egative indicators are those whose high values have a negative contribution to sustainability (economic and environmental indicators) and positive indicators are those that have a positive contribution to sustainability (social indicators)”.

Some other remarks on social impacts (positive and negative) can be done: a noteworthy feature of social impacts is that they produce their effect as soon as there are changes in social conditions. Moreover, it is not only the stakeholders who are subject to these impacts, but they also provoke an active response, implying a certain degree of dynamism. For this reason, they are difficult to identify and are situation/site-specific (Slootweg et al. 2001). They refer, in addition, to both quantitative variables (demographic and economic) and to changes in values, belief system and in the perception of the context in which they are being produced (Lahtinen et al. 2014).

An example of context-related positive impacts is given in the paper of Jørgensen et al. (2010), in which the authors highlight that child labour can be regarded as a positive impact in some situations. These could include: helping children to develop discipline, responsibility, self-confidence and independence, teaching them how to manage money, and providing them with working skills.

Questionnaires

With regard to the questionnaire sent to those authors of the case studies as well as to a number of experts in the S-LCA field, 13 were answered out of the 50 questionnaires sent.

Starting from the responses collected until now, some preliminary conclusions can be drawn. One of the first problems in dealing with positive impacts is found in the definitional phase. Indeed, the authors surveyed showed less agreement in providing a definition of positive social impact: these definitions are almost perfectly divided between: “The net positive effect of an activity on a community and the well-being of individuals and families” and “An improvement related to the previous situation”. This situation is also due to the subjectivity of the issue itself. It must be emphasised however that a positive impact is not the absence of a negative one.

After having analysed the questionnaires collected until now, it appears vague to define a positive impact generically as an improvement, because the beneficiary and its time duration are not specified. It is important to underline instead who is the subject of the improvement and who acknowledges it: if it is a top-down improvement it can concern several stakeholder categories, but it may fail to record important changes that occur at the local level (Lahtinen et al. 2014).

Regarding the necessity, or not, to set new Subcategories, the authors interviewed are in disagreement, as well: i) there is a part of those who claim that new Subcategories should be set; ii) another share which could not say if this is necessary or deemed

necessary only in cases where it applies a specific IA method; iii) most believe that the existing Subcategories are enough. The definition of new Subcategories would not be, indeed, the good way to identify social impacts, but it would be more interesting to find social impacts in the literature on social science. It is therefore not necessary to set new subcategories if the relationship (pathway) to assess social impacts is not identified.

Positive social impacts, in the opinion of the authors, can be regarded as a subjective, context-related issue and have to be assessed as in the case of negative ones (the same category of indicator can display a positive or a negative impact, it depends on the previous situation that is set to be the reference).

4. Conclusions

The concept of positive impacts has arisen in the field of Social Impact Assessment (SIA). Indeed, after having performed a literature review and analysed a set of papers, no shared definition of positive social impacts as part of the S-LCA methodology could be deducted. It will be therefore necessary in the future to put it to debate amongst researchers. As a result of the questionnaires, it should be noted that the unanimity of the authors believe that research in the context of positive impacts is useful for the general advancement on social impacts.

In the framework of social positive impacts meant as “win-win” situations, helping communities (and other stakeholders) to identify development objectives and ensuring that positive results are maximised, may be more important than minimising the damage originating from negative impacts. Generally speaking, positive outcomes should be the focus of the development (e.g. capacity building, empowerment, realization of human and social potential).

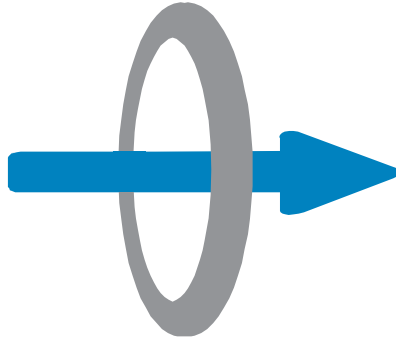
As far as indicators are concerned, it can be highlighted that positive impacts can be among the main driving forces towards sustainable development; therefore, it is hoped that future work will examine the role of indicators in S-LCA.

As only preliminary results are reported here, more research needs to be performed to continue the ongoing work through the collection of questionnaires filled in by experts in the S-LCA field.

Future research developments may concern identifying social evaluation criteria to establish what is to be considered as “positive” and examining in depth the context (for example: in what way could the context evolve after a change occurred that led to an improvement?).

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Session 2

The nature of social LCA

Social Life Cycle Assessment in a constructivist realism perspective: a methodological proposal

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1. Introduction

Social Life Cycle Assessment (sLCA) emerged in the last decade as a methodology to evaluate social impacts deriving from the life cycle of a product or service. However, there is not yet consensus on a specific procedure and many different methodological proposals have been developed (Wu et al., 2014). This diversity is mainly observable in the use of different semantic meanings (such as in the definition of impact, effect and performance), in the underlying social sustainability concept (even if not always explicit) and in the perspective of the assessment, that can concern the product, the firm, the affected actors, the decision-makers. Actually, it is arguable that the main reason of these methodological differences has its roots in the underlying paradigms, inherent every research process. A paradigm can be considered as a set of basic beliefs concerning the worldview of the researcher, i.e. the nature of reality (ontology), the relation between the knower and what is under study (epistemology), and how the researcher can find out knowledge (methodology) (Guba, 1990; Guba & Lincoln, 1994; Mertens, 2007).

The present work is part of an ongoing three years research project, whose aim is to bring the methodological debate on sLCA to a paradigm level by analyzing the current approaches applied by sLCA practitioners and by comparing two different methodological proposal based on divergent epistemological premises. This choice has been made according to Guba & Lincoln (1994:105) who affirmed that “questions of method are secondary to questions of paradigm, which we define as the basic belief system or worldview that guides the investigator, not only in choices of method but in ontologically and epistemologically fundamental ways”. In this direction, the research project will compare two different methodologies for sLCA (i.e. two ways of obtaining indicators for the assessment) based on opposite paradigms, namely a positivism-oriented paradigm, and a interpretivism-oriented one. The present work represents the development of this latter. The methodology here proposed will be applied to an important agricultural supply chain in Southern Italy, i.e. citrus growing in Calabria region, the second agricultural sector in terms of surface and the most important in terms of average standard production¹, but unfortunately also renowned for social problems.

¹ Expressed in €-farm-1-year-1 and calculated as the total value of standard productions divided per number of farms.

2. A constructivist realism paradigm for sLCA

While positivism-oriented philosophies have dominated scientific research in the field of the so called “hard sciences” (Tacconi, 1998), in the development of sociological theories it is difficult to recognize a dominant paradigm and more worldviews have been hold simultaneously (Batty, 2008; Tashakkori & Teddlie, 2010), that is why sociology is considered a multiparadigmatic science (Ritzer, 1975; Corbetta, 2003; Batty, 2008). As the lines between paradigms are often very fine, Table 1 shows two main orientations - positivism and interpretivism - that can be considered the umbrellas to which almost all of them tend.

Table 1: Examples from two of the principal research paradigms.

	Positivism-oriented		Interpretivism-oriented	
	Positivism	Post-positivism	Interpretivism	Constructivism
Ontology: What is reality?	Naïve realism. Objective reality.	Critical realism. Reality is imperfectly apprehendable.	Subject and object are dependent. The real essence of the object cannot be known. Reality is constructed.	
Epistemology: How do you know?	Dualism researcher-research. Replicable findings are “true”. Reality can be explained.	Dualism is not possible. Replicated findings are “probably” true. Impossible to fully explain reality.	Knowledge is interpreted. Reality can be understood.	Knowledge is constructed. Reality can be constructed.
Methodologies: How do you find it out?	Experimental, deductive. Mainly quantitative. Relationship cause-effect. Statistical analysis.	Experimental. Mainly quantitative methods, manipulative. Scientific Community plays an important role of validation. Statistical analysis. Probability sampling.	Interpretation. Mainly qualitative methods. Purposive and multipurpose sampling.	Mainly qualitative methods. Purposive and multipurpose sampling. Stakeholders involvement.
Goodness or quality criteria	Rigorous data produced through scientific method.	Statistical confidence level and objectivity in data produced.	Intersubjective agreement and reasoning reached through dialogue, shared conversation and construction.	

Adapted from: Guba & Lincoln (1994); Girod-Séville & Perret (1999); McKenzie & Knipe (2006); Lincoln et al. (2011); Phoenix et al. (2013).

Since sLCA is yet a methodology under debate at academic level and many new methods are ceaselessly proposed, it is important to state which is the underlying paradigm. A literature review conducted among about 74 scientific papers and grey

literature published on the subject of sLCA and papers that took into account social aspects as part of a Life Cycle Sustainability Assessment (LCSA), revealed that the choice of methods applied is hardly explicitly justified by epistemological reasons. The results of the bibliographic survey (here not fully reported for reasons of space) showed that ontological and epistemological issues have been explicitly taken into account just in two papers by Sala et al. (2013a; 2013b) on LCSA.

To build the present methodological proposal the study has been based on a constructivist realism paradigm, as constructivism-oriented research approach that embeds at the same time some positivism-oriented foundations and looks for their methodological complementarities (Cupchik, 2001). Indeed, this study starts from some assumptions typical of interpretivism-oriented paradigms, e.g. that subject and object are dependent and that knowledge can be constructed through participation; and from positivism-oriented assumptions, e.g. that reality can be explained, but not totally, and that the scientific community plays an important role. In particular, the authors have looked for similarities among what has been traditionally considered contrasting, building bridges between different social ontologies, as proposed by Cupchik (2001).

The aim is to verify the constructivist realism paradigm as an epistemological option for developing sLCA, fulfilling requirements for: (i) completeness, assessing a wider variety of impacts; (ii) objectivity, by involving external experts; (iii) legitimacy, by involving local actors and stakeholders as active subject in an iterative and inclusive process and not as passive receivers. To do this, the authors borrowed different methods and tools from yet existing methodologies and approaches, chosen for their relevance or efficacy to solve each step. Moving from Patton (1999) that rejects the methodological orthodoxy in favour of an appropriateness of methods, we propose an approach for sLCA where each step is developed through the application of an appropriate tool or technique borrowed from different families of research methods.

According to the literature review conducted, the resort to different methods chosen for their relevance to each step is quite new in the field of sLCA. Actually, following Previte et al. (2007), it is important to highlight that it is not in the typology of methods to be applied that our ontological and epistemological position is revealed, but in the choice of applying different methods together, the willingness of involving local actors, stakeholders and external expert, and in the interpretation of results. Indeed, Patton (1999:1207) affirmed that “the issue need not be quantitative versus qualitative methods, but rather how to combine the strengths of each in a multimethods approach to research and evaluation. Qualitative methods are not weaker or softer than quantitative approaches; qualitative methods are different”.

As the development of sLCA is still under debate, the authors are aware that the present study should be considered a methodological option among others for sLCA: the aim, indeed, is to lead the debate at an ontological and epistemological level, on how the knowledge is reached and how the indicators are chosen.

3. Material and methods

Following the typical phases of Life Cycle Assessment (LCA), the present methodological proposal for sLCA (Tab.2) is tailored for each step with the help of specific tools borrowed from qualitative, quantitative and multicriteria research methods, taking advantage from their complementarity, as inspired by the constructivist realism approach (Cupchik, 2001). As it is in other LCT tools, this methodological process is iterative, and each phase can be revisited in the light of results from subsequent steps. A key role is played by participation (of local actors, stakeholders and external experts), that is emphasised to both legitimate the choice of impact categories and to make the assessment relevant to local urgencies. Once the product or service to be assessed will be chosen, data gathered from official statistics and local surveys will enable to define the territorial contexts associated to the functioning of the product life cycle.

The first step of our methodological proposal will concern the selection of stakeholders to be involved, here intended as affected actors. The “stakeholder theory” (Mitchell et al., 1997) is applied to identify three criteria from a normative perspective: their influencing power, the legitimacy of their relationship with the system under study and the urgency of their claims towards not a single firm, but the whole supply chain. A web questionnaire will be set up to interview a wide range of typology of actors (belonging to the territories previously selected) and gather their opinions about which typology of stakeholder is concerned in each life cycle phase² and with which intensity, assigning a score on a scale from one to five for each of the three criteria. The life cycle phases corresponding to the stakeholder typologies with a score higher than the average will be included in the system boundaries. Both statistical and territorial analyses and the choice of system boundaries will guide the definition of the scenarios to be compared, according to discriminating factors emerged during the above mentioned phases.

The second step will concern the definition of the dimensions of social sustainability, i.e. what is worthwhile sustaining from a social point of view. A sample of stakeholders will be involved into a “Q-methodology” application (Stephenson, 1953), a tool for the analytical study of subjectivity (Brown, 1993) and people’s own perspectives, meanings and opinions. The Q-methodology will enable to define the so called Areas of Protection (AoP) for sLCA.

² Life cycle phases are designed at researchers’ discretion according to a supply chain perspective. For example, the present methodological proposal will be applied to citrus growing sector in Calabria region (Italy), and the corresponding life cycle phases will be: input supplying, farming, conditioning and transport, retailing, wholesaling, industries, consumption, waste management.

Table 2: Methodological steps

Step	Actors involved	Activity	Tool	Result	sLCA phase
1	Researchers	Stakeholder identification	Stakeholder theory	Actors groups affected by the system under study, scenarios	Goal and Scope
2	Affected actors	Identification of social sustainability dimensions	Q-methodology	Areas of Protection (AoP)	
3	Independent experts	Taxonomic ordering (AoP, criteria, indicators)	Delphi	Social Impact Matrix construction (SIM)	Life Cycle Inventory
4	Researchers	Data gathering and calculation of indicators		SIM filling	Impact Assessment
5	Researchers, Affected actors, Experts	Normalisation and weighting	AHP	Ranking	Interpretation of results

In the third step, external experts will be involved, through the Delphi technique, in a group decision-making process to select and taxonomically order criteria and indicators to be used in evaluating the scenarios, according to the social values previously selected by stakeholders. The choice of this qualitative method is based on its ease of use and its suitability for complex problems for which there is not exact knowledge about a phenomenon (Miller, 2001, Skulmoski et al., 2007; Vidal et al., 2011).

Once criteria and indicators linking the functioning of the life cycle to the AoPs will be defined, a Social Impact Matrix (SIM) will be constructed (De Luca et al., 2013) and then filled in by researchers with elaborated indicators. Finally, life cycle impact assessment consists in normalising and weighting each indicator according to the preferences of the actors, derived through the application of an appropriate multicriteria analysis tool, the Analytic Hierarchy Process (AHP) by Saaty (1990). This weighting process will permit to compare different categories, to rank the scenarios, and to quantify social impacts of a product life cycle in a comparative way.

4. Expected results and conclusions

The present study follows the assertions of McKenzie & Knipe (2006) that a purity of methods is potentially impossible in social research, and agrees with Teddlie &

Tashakkori (2010) and Howe (1988) that a wedding of methods is possible, and different paradigms can be compatible.

Starting from these assumptions, a constructivist realism paradigm has been the base upon which the current methodological proposal has been planned. Qualitative, quantitative and multicriterial methods will be used in a complementarity perspective to analyse the whole complexity of social impacts deriving from the life cycle. Participation will play a key role to make the assessment legitimate and adherent to reality.

Expected results concern the accommodation of the strengths of positivism and interpretivism as proposed by the constructivist realism (Cupchik, 2001), here assumed to assess the whole social impacts of a product life cycle, that would mean reaching objectivity and generalization, typical of positivism-oriented approaches, and richness in meaning, holism and comprehensive understanding, typical of interpretivism-oriented approaches. Nevertheless, it is in our opinion that the current debate on sLCA development should concern ontological assumptions and epistemological positions, before than methodological issues.

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Listening to the stakeholders: plea for a participatory approach – and some grounded theories – of impacts in social LCA

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1. Context and scope

The UNEP/SETAC Guidelines identifies :

- a “general research need” to “detail the stakeholder approach”: “A peculiarity of S-LCA is the stakeholder approach. Research groups are currently working with the following categories: worker, consumer, local community, society and value chain actor. Detailing the stakeholder approach and assessing if it should be broadened is a valuable research field to investigate.” (p. 82); and
- a “limitation due to development mode”: “S-LCA tends to develop indicators in a top down manner that may not represent the views and priorities of the impacted people or their communities. Therefore, it is important to get stakeholders involved and engaged as much as possible in the study process.” (p. 77).

2. Towards a participatory approach – and some grounded theories – of impacts in social LCA

1. The search of what’s worth

1.1. From the need to work backwards...

To identify the effects and impacts of a given activity, we cannot proceed in S-LCA as simply as in E-LCA.

In E-LCA, it is possible to take, as starting point for such a research, an inventory of material and energy flows of an activity, in the form of a simple table of all basic inputs

and outputs of energies and materials (physicochemical elements) of this activity. And, from this inventory, to go in search of their various consequences.

In S-LCA a wide variety of intangible, immaterial phenomena may be the cause of an indefinite range of consequences, effects and impacts.

As we are unable to conduct a systematic survey of all the phenomena that could potentially have any possible effect and, a fortiori, explore all these possible effects for each of these phenomena, we are obliged to work backwards (Macombe, 2013).

Therefore, we need to start from some hypothetical effects and impacts – actually, from some impact points, that is to say, from the adverse or favorable (final or intermediate) states of the different social aspects we are interested in. This, in order to determine which activity outputs (“performances”), i.e., the SLCA equivalents of the ELCA “inventory data”, must be recorded, collected, because they could be the cause of these assumed effects and impacts.

This implies having certain assumptions, namely, some underlying theories (explicit or implicit) on the possible causal relationships between the various “performances” (“social inventory data”) assumed to be relevant and the adverse or beneficial states of the different social aspects we are interested in.

1.2...to a reference to the standards of CSR...

The critical problem here is that the concepts involved in social phenomena are all concepts “essentially contested” within the meaning of Gallie (1956), that is to say, some irreducibly contested and questionable notions by their very nature.

For circumvent this difficulty and in order not to be vulnerable to criticism, the UNEP / SETAC has taken support on existing and widely distributed standards, and therefore assumed to be “consensual” [cf. the recurrent references to the conventions, established practices, state of the art, both in the context of relevant institutional forums and inside ad hoc expert communities: “(...) *reflect internationally recognized categorizations/standards (...) or result from a multi-stakeholder process (...); [X] is not a dimension that has been put forward in CSR framework and literature. It is not being considered, in the moment, as being one of the key issues (...); comparable to GRI and other international schemes (...); following the common practice (...) according to international agreements (conventions, treaties etc.). (...) best practices at the international level have been taken into account: international instruments, CSR initiatives, model legal framework, social impacts assessment literature (...)*”].

1.3...at risk of bias of perspective

But these standards may also particularly reflect the worldviews of a very specific “epistemic community” - in the sense of Haas (1992) - , those of the designers and proponents of the standards referred, these high level experts-consultants, whose

international careers cause them to move seamlessly (frequently and without apparent difficulties) from transnational corporations to NGOs, then from NGOs to national and international public institutions and organizations, and return - as this has been well established in the case of some multi-stakeholder forums (see Fouilleux, 2013).

So this particular epistemic community (however well-trained and informed it might be) can't claim having a priori an universal viewpoint. Its own views, including on matters within its competence and expertise, are just as special as would be those of any other specific epistemic community on the same issues.

Therefore, the question arises concerning the relative legitimacy of the particular perspective of this epistemic community of the designers and proponents of these standards. And this question is particularly acute with regard to the legitimacy that could possibly claim some divergent viewpoints from any set of material stakeholders.

2. A matter of stake

2.1. From a priori categories of stakeholders...

Five "major" categories ("recognized") of stakeholders are highlighted by the UNEP / SETAC, i.e.: workers / employees; local community; society; consumers; and value chain actors.

Retaining these five categories a priori, the UNEP / SETAC appears to keep the stakeholder concept essentially in line with the first of two "branches" of the dual definition of Freeman, recalled in note 34, p. 47:

Stakeholders are "...those groups and individuals that can affect, or are affected by, the accomplishment of organizational purpose" (R. Freeman, 1984).

These five categories cover essentially categories of stakeholders qualified in the CSR literature as "primary" by Clarkson, because they are voluntary (Clarkson, 1995); and "legitimate" by Hill and Jones, because they are contractors or in exchange relationships with the firm (Hill and Jones, 1992).

In this perspective, the stakeholders appear obviously being *"...those groups and individuals that can affect the accomplishment of organizational purpose"*.

2.2...to impact pathways of the firms

However, SLCA's practitioners should logically pay more attention to the other branch of the dual definition of Freeman.

Indeed, Freeman argues for a strategic management approach based on taking into account the impact of the action of stakeholders on the objectives of the firm. But he

actually founded his argument on the observation that most of potential stakeholders usually don't seek to have any impact on the firm.

They don't do it, except if they have to, as a required response to the initial impact of firm's actions on the achievement of their own goals. So they started to have something at stake, due to firm's actions.

In other words, genuine stakeholders appear always to be stakeholders a posteriori, due to previous action of the firm: *"...those groups and Individuals that are affected by the accomplishment of organizational purpose"*.

3. In a critical perspective

3.1. From the legitimacy of the point of view of the stakeholder...

It is precisely in the fact of suffering the impact of the firm's pursuit of its objectives that relies the source of legitimacy of the stakeholders to assert their own viewpoints on the nature and the extent of this impact.

In a direct extension of Kant's categorical imperative, Evan and Freeman have indeed noted that *"no one should be used as a means to some other purposes whatsoever without the benefit of full rights to participate in any relative decisions"* (Evan and Freeman, 1993).

They deduced that *"(...) stakeholders have inalienable rights to participate in decisions that substantially affect their welfare or that concern them as resources devoted to the purposes of others"*.

"Which implies the legitimacy of claims made to the company" and "explicitly defines the duty of the management to recognize these claims" (Evan and Freeman, 1993).

Evan and Freeman outline thereby the essence of the principle of accountability as it comes in the economic universe: the firm must account for its behavior with its various stakeholders.

This is exactly what the "AA1000 AccountAbility Principles Standard 2008" of the consulting firm AccountAbility have presented as a set of three related principles, which set should become now essential as a framework for the development of S-LCA studies:

- Inclusiveness: people should have their say in the decisions that have an impact on them.
- Significance: policymakers must identify the real problems and to have a clear position about them.
- Reactivity: organizations must respond seamlessly for their actions.

3.2...to the participatory development of grounded theories of social impacts

For as long as we adopt the “AA1000 AccountAbility Principles Standard 2008” standard as a framework in the field of S-LCA studies, we are therefore led, in matters of identification, exploration and definition of social impacts, to the development of an approach that turns out to be:

- “backwards”
- “bottom-up”, and thus inductive
- participatory
- falling within the framework of the “grounded theories” developed by Glaser and Strauss (Glaser & Strauss, 1967).
- and fitting in the end on these epistemic and practical bases in the broader perspective of the theory of the inquiry of John Dewey (Dewey, 1938).

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Searching for social peace: A theory of Justice to determine the nature of impacts in social LCA

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1. Context and problem

The social life cycle assessment is a method under construction. It is used to determine the social impacts caused by one change in one life cycle. A crucial question is which categories of impact should be assessed. We must generate a theoretical framework to determine “what is worth in the social world” before answering this question.

Herein, we discuss approaches that are explicitly devoted to life cycle assessment. In sociology, the Ecological Modernisation theory (Mol and Spaargaren, 2000) addresses changes in policies and States to overcome the deficiencies of the traditional bureaucratic State in environmental policymaking (Buttel, 2000) that benefit « private eco-efficiencies ». In economics, Feschet and Garrabé (2013) are concerned with development. They articulate the Multiple Capital Model with the concept of « Capacity » that stems from Sen’s Capability concept and is used for all types of capital. In practical philosophy, Reitingger et al. (2011) also refer to Sen and Nussbaum’s Capability concept and apply it to different aspects of the central concept « individual well-being ».

The three approaches employ the strict methodological individualism. They address situations as pure and perfect competitive markets, even though this is rarely the case. In social sciences, two main schools of thought are in conflict. *Economism* assumes an individual logic, by which agents make rational choices to optimise the use of resources. In contrast, *holism* assumes that norms and values alone shape the causal determinism of choices; It is the “culturalist a priori”. Regardless of the social theory, it must choose its position.

The three approaches are embedded in the sustainable development framework. We cast doubt on the idea that our societies are experiencing sustainable development. On the contrary, societies do their best to avoid sustainability (Blüdhorn, 2013). We can consider the social phenomena that surround ecological stakes as power struggles for income (Leroy, 2010).

Eventually, the three approaches are uninformative regarding the expectation that the life cycle (after the change) will not only be the “best” but will also be permanent.

While life cycles involve areas with various geographical scales and link different human groups (southern workers and northern as well as southern consumers, etc.), the permanence issue raises specific concerns.

We suggest setting a normative theoretical framework to social life cycle assessments to consider these concerns.

2. Towards a theoretical framework for social LCA

2.1. A theory of what is worth in the social world

The goal of this work is to discuss the nature of the impacts that are relevant to a social LCA. The theoretical framework is based on the following premises.

A third option lies between strict methodological individualism and holism. Searching for the foundations that underlie agreements that facilitate social peace (outside of violent conditions¹), Boltanski and Thévenot (1991) highlight the role of “conventions”. The only legitimate justification for a widely accepted agreement involves establishing justice between humans. A common system of constraints (Thévenot, 2002) called « Grammar » of political and social connections, provides a framework for interactions (Piteau, 1992). Individuals have the capacity to change the particular register of Justification that they embrace, depending on the circumstances (Thévenot, 2004).

The general context is not sustainable development. To date, humans live in a context of resource scarcity and a lack of available life milieu per inhabitant. We assume that social life cycle methods must be constructed in the context of no growth (Georgescu-Roegen, 1995). The social phenomenon that must be understood is how to “live together in the world” (Thévenot, 2004) despite these conditions.

Different groups of humans are involved in each step of the life cycle; they are linked by the life cycle, even if they do not know one another. Diverse groups can live a peaceful and permanent coexistence if they feel equity among one another through shared created / destroyed values, stemming from life cycle changes.

In the context of growth scarcity, the question for social assessment becomes the following. How is permanent social peace obtained or preserved? Social peace is unavailable without an agreement to live together. In a particular case, people must discriminate between what is good and what is wrong (Boltanski, 1990). The book « De la Justification » by Boltanski and Thévenot (1991) is the « discours de la méthode » of social science based on such an agreement. The authors suggest the model of the sense of Fairness and common good, based on practical experiences. Neither universalist nor totally pluralist, the Grammar opens the intermediate path of limited plurality for models based on such an agreement (Piteau, 1992). Boltanski

1 Violence is defined as an act that disrespects justice without explanation (Boltanski and Thévenot, 1991).

and Thévenot demonstrated that an apparent plurality among concepts of Justice relies on the same common Grammar. This Grammar is constructed from proposals regarding the state of the World (referred to as « axioms ») on which people must agree before reaching particular agreements. Thévenot (1993) states that the concept of Justice is relevant for universal issues; he prefers the term Ethics (a concept of Justice scaled down to consider more local common goods), when it comes to more limited issues. The changes in life cycles, therefore, confront Ethics, which are established by human groups to live in peace together. Determining the way that Ethics are affected by change is an accurate means of assessment when it cares about social peace. The reference state is never « tabula rasa » in the social domain.

2.2. A normative conceptual framework for social LCA

2.2.1. Area of protection-Involved groups

In the vocabulary for life cycle assessment, the « area of protection » to be established is « permanent social peace ». We suggest assessing change x based on the potential change it entails for the capacity of the human groups involved in an agreement. The relevant question entails whether Ethics articulated by the human groups would be upset by change x . Ethics are rooted in a common proposal on the state of the world (table 1).

2.2.2 . The social impacts subject to the assessment

The table 1 shows axioms of the Grammar of Justice implemented for the local common good (first column) and the conditions for the axiom to occur (second column). The third column suggests the social impacts of change x subject to the assessment.

The nature of the worth is determined by the nature of the local common good. We provide two examples. If the local common good is the reputation of the city as a tourist area, the group of equivalent humans is formed by the inhabitants, the highest state of worth is for the person who directly contributes to the area's reputation (militant hotelkeeper or citizen flourishing balconies), despite a person who litters in the street, who is considered to be small. If the local common good is "traditional family farming in the region", the group of equivalent humans consists of all people who work in the agricultural fields. The highest state of worth is considered as one who ploughs the ground in accordance with tradition; the small is an "industrial" farmer. Clearly, an important change x in the life cycle (a new plant is created in the city devoted to tourists, or the change x causes an agricultural industry to disappear) might upset the local common goods.

Table 1: Social impacts subject to assessment

Axioms describing one local common good	Conditions for the axiom to occur	Social impacts subject to assessment in the group
A1 A definition of a common humanity : There is a group of equivalent humans	To be alive as well as in good health and considered equal to the others with regard to rights	Changes in mortality, health, and equality with regard to rights
A2/A4 There are different possible states for the actors (at least one small and one higher state of worth)	Searching for higher state of worth	Changes in the search for the higher state of worth
A3 A common dignity: In the group, everyone has equal power to reach* higher states of worth	The potential for reaching higher state of worth is fair	Changes in the fair access to higher state of worth among the group
A5 Reaching higher state of worth requires a sacrifice	The value of the sacrifice is acknowledged	Changes in the value acknowledged to the sacrifice
A6 There is a local common good, specifying the welfare associated with each state of worth, and which benefits other actors	The value of the local common good is acknowledged	Change in the search for higher state of worth

* Under this condition, ideals that assume special physical characteristics (breaking sports records or eugenics) are excluded from Ethics.

The life cycle change (for instance, the industry evolves such that it requires a less populated work force) might affect health, if not mortality, among the group. However, it might also only affect part of the group (only the foreign agricultural workers) such that they are no longer considered to be equal to the others with regard to rights. As shown, we do not emphasise “basic human rights” but “equivalent human rights” among the group.

2.2.3 Two aspects of the convention that the agreement is based on

A change in the life cycle might affect the basis of the former agreement in two ways. Either by modifying (1) the characteristics of the persons, which facilitated their agreement, or by affecting (2) the local common good. For instance, imagine a society of potters, which entails a new numerical esoteric technology that modifies the rights of who master it compared to those who do not (case 1). The previous local common good was “creating a hand-made quality pottery”. If the new technology is used, the new common good might become “creating a pottery using the numerical technology” (case 2). Considering both cases, we make the following distinction.

- On one hand, axiom 1 provides people equivalent dignity. One question is whether change x will strengthen or impede this axiom?

- On the other hand, other axioms explain the formulation of the previous local common good before change x. The question is whether and how change x will affect the local common good ?

The changes involving axiom 1 produce generic impacts. Therefore, it is a relevant consideration, whatever the ground. Thus, we can establish the generic relationships to assess them. In contrast, it is impossible to know whether a local common good will be threatened (or strengthened) by change x and its nature without a specific inquiry. We require a ground survey (involving experts). Eventually, we must combine the assessments from generic relationships with a specific assessment to provide a satisfactory evaluation of the social impact from change x.

The table 2 highlights the social impacts subject to assessment and suggests issues that indicators should consider. Certain indicators are linked with realising axiom 1 (in *italics*), while the other indicators must be determined on a case-by-case basis because they are relevant to a local common good, which is always specific.

Table 2: Suggested issues for an assessment of social change

Social impacts subject to assessment	Comments	Issues to be considered
Changes in mortality and health	Within the group	Changes in life expectancy, life expectancy with good health, infant mortality, and morbidity etc.
Changes in equality with regard to rights	Within the group	Increased inequality with regard to rights (e.g., income and training inequalities)
Changes in the search for worth ; the value of the sacrifice; and the nature of the local common good	The question assesses the change in the formula of the local common good.	Changes in motivation, culture, etc.
Changes in fair access to worth	The question is the meaning of the local « dignity », regarding the local common good.	Changes in local dignity for certain group members

The design of the human groups under scrutiny must be accurate. Adding plant workers and plant owners is meaningless, except if they have an established local common good. Similarly, users who do not know each other do not compose a relevant group. The relevant human groups are the groups who have elaborated a local common good. A life cycle always involves several human groups, each often include a local common good.

2.2.4. Permanence when many human groups are involved

Life cycle changes are often motivated by the expectation that the value chain underlying the life cycle will become more permanent. In the value chain, the participants share the created values, including money, cultural values, or prestige, among other considerations. For a permanent life cycle, it is preferable that everyone thinks that he/she draws some value from the value chain. Large businesses understand that contradicting the opinions and values of society may endanger its future (Gabriel et Gabriel, 2004). Clues that the evolution is fair include the following.

- change x improves the wages above fair wages
- change x improves the work conditions
- change x improves the reach to goods/services for users or consumers (Musaazi et al, 2013)
- change x improves the recycling rate of the good, among other considerations

These issues provide information on the likelihood whether the value chain will become more permanent. They provide important clues to its success, although it is the interpretation by the actors that is relevant.

3. Discussion and Conclusion

Under this theoretical framework, Dreyer et al. (2006) are correct to place such importance on dignity. Here, dignity is not universal dignity, but dignity that ensures equality with regard to rights within the human group.

The framework justifies considering certain specific impacts (determined based on the local common good) and generic impacts. Social peace does not only stem from tension caused by value chains. But value chains can strengthen or impede social peace (Neilson and Pritchard, 2009). The theory provides a list of impacts and issues used to determine the indicators. Depending on the conditions, one could develop different indicators to monitor the impact.

Isolated people are not considered. As we seek permanent social peace, the human groups who have developed an agreement to live together (any peaceful society, plant workshop, or user association) are especially relevant for the model. As such, fragile or marginal groups (children, disabled people etc.) that are unstructured are not specifically considered herein. We are concerned with the « rights and concerns of the poor » (Bryant and Jarosz, 2004) only under this condition. The groups that can upset social peace in a certain capacity will be highlighted.

As the Grammar of Justice was constructed from European political philosophers, its scope is European Ethics.

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How to assess the social value of a steel product?

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1. Context and scope

Sustainable development (SD) has been on the rise on governments and firms' agendas since the mid-1970s. At first, they have paid more attention to environmental issues (at that time, social risks were more under the control of welfare states and private insurances) but the development of economic globalisation have triggered some concerns on the social - or societal¹ - pillar of SD. As a consequence, governments have launched programs (Agenda 21, SNDD...), NGOs have grown (Oxfam, HRW...), while corporations have begun to claim they were socially responsible or were able to improve their CSR by themselves; however, ongoing discussions also show that their effective implementation still raises some issues [Capron, Quairel-Lanoizelée: 2007]. ArcelorMittal² illustrates well this trend by publishing its first CSR report in 2007 and assuming that the expectations of society for corporations to be accountable and part of the solution is growing considering the current global trends that are shaping the world - the balance of the global economy is shifting, water and energy systems are under pressure and the world's resources are squeezed as never before [ArcelorMittal: 2013].

Such efforts made by corporations raise several criticisms and comments either to object to them or to improve them. This research project addresses the second issue, in order to enlighten the company about decision-making processes and making them more efficient and relevant, while testing the limits of the technical tools of SD management (at the level of a company or a sector). The purpose of this contribution consists therefore in providing a response to ArcelorMittal's need for assessing its social contribution to society, according to its current CSR strategy and to the SOVAMAT initiative it has launched in 2005³: beyond the rising constraints and challenges faced

1 Hereunder we use the term 'social' in its broadest meaning, including both professional relationships within corporations and relationship beyond the field of the economy (gender inequalities, happiness...).

2 ArcelorMittal is the world's leading steel and mining company, operating in more than 60 countries. Steel products are integrated in all major goods of the western way of life (automotive, building, food packaging...).

3 SOVAMAT ("Social value of Materials")'s overarching objectives are to identify the role of structural materials (steel, concrete, cardboard, wood, etc) in a post-carbon society and to prepare the stakeholders of the materials value chains for the subsequent changes to come.

by the society, it must deal with the paradox of Condorcet who has demonstrated that no decision can combine everyone's preferences.

Identifying the focal and priority points for progress and the relevant objectives for each of these points, is a twofold issue (as with any governmental action or industrial quality strategy [Chanteau: 2011]): ethical relevance on the one hand, and efficiency on the other. Given the fact that such issues are intertwined, it leads us to test a systemic methodology : i) the focus group methodology, taking into account the scientific literature regarding stakeholders theory and multi-stakeholders CSR practices; ii) linked to the Social Life Cycle Assessment (SLCA) methodology, which takes into account the globalization of the value chains.

LCA has indeed done much to enforce a transverse approach that cuts across business boundaries throughout the whole life cycle of a product and the stages of its supply chain [UNEP: 2011]. But whereas early work on LCA has been mainly focused on assessing environmental impacts of products, enabling the measurement of their ecological footprint⁴, which is by definition always expressed in a negative way – because it is today not possible to produce and develop without polluting the environment - it is challenging to also assess the social contributions of an industry, which are both negative and positive [Birat et al: 2008].

This comprehensive assessment of impacts generated by the production of steel and the use of steel products might provide necessary knowledge to decision-makers to tackle unavoidable trade-offs between pros and cons, synchronic and diachronic approaches, micro and macro levels of analysis, etc. Since this research project has been launched in June 2014, this paper is basically programmatic and will contribute to ongoing work on the significance and the limits of SLCA methodologies [Macombe (dir): 2013].

2. Main text

2.1 Defining the objectives of the method, a matter of evolving concepts: towards the assessment of social footprint or social value of a product?

As pointed by Parent & al [2010], the result of a social assessment varies, depending on the SLCA approach used. It is therefore essential to define exactly what the main objectives of the present research project are, which will determine which methodology will be developed to meet such objectives.

Therefore, some key preliminary questions needs to be, if not resolved yet, at least formulated.

4 EC – JRC & IES [2011] *Product environmental footprint guide*, Italy

2.1.1 Assessing the “social footprint” of a product

The SLCA UNEP methodological Guidelines [SETAC: 2009] are based on the ISO 14040 standard regarding environmental LCA. LCA is used as a tool enabling the assessment of ecological footprint of products⁴. In order to achieve this goal, the concept of “functional unit” is used so that comparison with another product can be established, or comparison with a previous LCA conducted on the same product.

“To imprint” literally means “to mark deeply something”. While it is clear that “something” refers to the bio-physical environment in a LCA and though it is sometimes possible to aggregate multiple causes (e.g. the gas emissions in the worldwide atmosphere), the LCA easily reaches its limits when two or more dimensions are tackled at the same time (e.g. biodiversity and energy consumption). The existing literature [Ekener Petersen, 2013] has proved it’s even harder to define it in a SLCA especially when “something” is such as multidimensional and ever evolving as within and between various “societies”. However, the qualifying term “deeply” could tend to define more precisely the scope of “something” and might refer to the concept of “materiality”, whose significance has increased in the field of CSR reporting. Materiality assessment is in fact often used to set goals, choose between new business models, and determine the most important areas of improvement.

Crutzen [2009] defined the concept of social footprint as “measurable parameter(s) enabling the assessment of progress towards the achievement of a social goal”, which implies to define “social goal”. She detailed that it is the “contribution to social conditions improvement on a regional or global scale”. But is the notion of ‘improvement’ as universal as Crutzen’s definition implies? ‘Who’ would be entitled to state it?

UNEP, as a global and inter-governmental body, has provided an answer by introducing the concept of stakeholders’ ‘wellbeing’ as constituting one of the ultimate social consequences [SETAC: 2009, p.43], implying that there could be others that will need to be identified and/or adapted. The concept of «well-being» is in itself still a key issue of research and policy (see OECD) in order to define the scope of what is the «social quality» of a product.

This proves that the definition of « social » aspects clearly depends on the point of view of the person/actor defining it. Any attempt for defining this dimension would provide a simplified vision and an adopted position regarding the reality (since all impacts can’t be considered, and also because it is necessary to focus on the causal relationships for a specific impact). Designing⁵ the definition of the objectives and the scope of the research project will therefore be one of the main challenges of our research project in order to focus the assessment on the relevant features that matter for steel products and production⁶.

⁵ By analogy with the methodology developed by Ostrom [Ostrom, Basurto : 2011]. For a synthetic outlook, see Chanteau & Labrousse [2013].

⁶ And by doing so, taking the risk to choose parameters that are specific to the activities of a company.

Besides, there is today a gap in the literature regarding the concept of “social footprint”, creating a doubt regarding the fact that SLCA is a relevant tool to assess the social footprint of a product. This has given way to other approaches (like the ‘social value’ approach: see below 2.1.2) or at least to the idea that the translation of the LCA methodology to SLCA is not sufficient.

2.1.2 Assessing the “social value” of a product

In its 2013 CSR report, ArcelorMittal attempts to illustrate how it contributes to the world through its products, by creating value [ArcelorMittal: 2013]. The creation of value for its stakeholders has been a key concept for its business strategy. It should consist in creating value for all its stakeholders affected by steelmaking process and steel products.

This contribution is nowadays difficult to measure, not only because of methodological problems (data collection, quantitative vs qualitative data, etc) but also because measuring “something” implies to define the reference/baseline enabling to conclude that steel products are at the origin of a change in comparison to this reference, change that can be either positive or negative. The results of this research project and discussions regarding SLCA methodologies will therefore be heuristic.

2.2. Defining a method for qualifying the social impact parameters to be selected

The challenge consists in defining the quality of the product that will be assessed. It is therefore necessary to combine the relevance of the approach (which kind of ‘social quality’) and the feasibility (how to measure the social quality and to identify social criteria) and how to sustain it throughout time [Chanteau: 2011].

The method leading to the production of indicators has to determine:

- the selected criteria (and the reasons underlying their selection);
- the reliability of the value assigned to those criteria (means of gathering information, margins of error, etc.);
- the conditions for weighting criteria, and methods of aggregation;
- the conditions for integrating the impacts throughout the value chain and life cycle of the product.

2.2.1 Based on a literature survey

A survey will be conducted on the concept of “wellbeing” presented here above in order to draw operational options for the definition of parameters required to characterize a ‘social quality’. It also covers the field of the ‘theory of value’ in economics which encompasses a range of approaches to better understand how, why and to what degree people value ‘things’. The current study will therefore provide a review on the different conceptions of ‘social quality’, including (but not comprehensive):

- compliance with core ILO conventions that define the concept of «decent work» (reference used for example for joining the UN Global Compact, for SA8000...);
- measurement of subjective well-being developed by the OECD in the 1990s;
- the framework of EUROSTAT indicators for the European Union sustainable development strategy (SDS);
- World Bank development indicators databases including the Millennium Development Goals (but not integrated in CSR management systems to date);
- local or national versions of human development indicators as developed by UNDP since 1990 (HDI, GDI, IP1, IP2...);
- different types of sustainable scorecards and other indicators of human development and wellbeing [Gadrey, Jany-Catrice: 2012; Van de Klerck: 2009].

This research project will also establish a survey of the literature and feedback on SLCA, still incomplete, in order to adapt them to the purpose of the present study: the attribute SLCA, the impact pathway approach and the SLCA based on the capabilities approach.

2.2.2. Based on a participatory approach

Literature review solely will not be sufficient for defining concepts and parameters. Each field of natural sciences provides quantitative answers on its specific subject study. The social dimension is, on the opposite, an aggregate assessment. The social representation of the product will be determined by the decision-maker (consumer, government, social responsibility investments funds ...), not only by producers or suppliers themselves or by some external experts [Trebeck: 2014]. The assessment of the social impacts of a product needs to assess a social quality based on this social representation.

In order to deal with this issue, the work will be built on the focus groups methodology [Kitzinger: 1994, 1995] already tested for institutions in the aluminium industry. As mentioned hereabove, the concept of "social impact" is not unequivocal nor those of 'wellbeing', 'social justice' or 'wealth'. The use of representative panels made up of internal and external stakeholders groups will reduce the existing risk in terms of legitimacy and credibility of the approach in case of unilateral choice. By involving stakeholders in the construction of these indicators, the use of these representative panels offers a method less likely to suffer criticism given the social issue addressed by the research project, and in the meantime, enables ArcelorMittal's insiders to also take a position on their preferences, as any other social group. This work will be launched as an 'action research' on a representative industrial site of AM producing final products and will be developed in two stages: development of a scope and development of a short list of indicators.

2.3. A two-step case study for integrating the whole life cycle of the product

The integration of impacts throughout the whole value chain of the product, from its primary components, represents a key challenge within the frame of social impact assessment. It constitutes in fact an important empirical problem for data collection and homogenization, as the upstream and downstream of the product involve legally independent companies in different countries (around 60 for ArcelorMittal). Few existing case studies in literature have in fact analyzed the use phase in a life cycle based approach, and this research project would be innovative in such an area [Ekener Petersen, 2013].

2.3.1 Case study - step 1

Given the current state of knowledge and the complexity of production systems, it is first more realistic to limit the assessment on the upstream segment of the value chain, ranging from mining to a steel coil, especially due to the diversity of products processed and manufactured from a coil, and the diversity of its co-products. In addition to the expected result, it allows to test the method on a first perimeter.

This first step will be conducted on an identified site and according to the capabilities approach [Garraabé, Feschet: 2013]. But, due to time constraints, it would be applied to a single indicator which could be the level of income since its contribution to wellbeing is well established in the literature surveys and since data prove in principle to be available. The technical and operational feasibility of the approach will therefore be assessed, especially by identifying all the methodological difficulties that may occur in the implementation of the method.

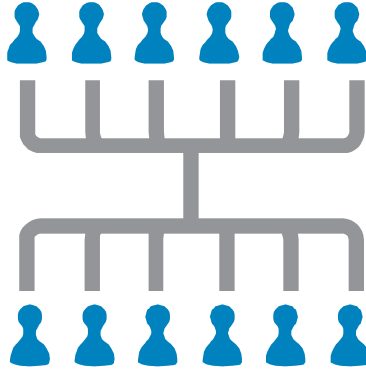
2.3.2 Case study – step 2

This first step as well as the tasks described in paragraph 2 should thus allow the testing of the comprehensive assessment of a steel end product on its whole value chain and life-cycle, which is far more complex because of the multiplicity of uses and modes of use. A specific steel product will be selected in one of the following areas of activity: packaging, auto, or construction.

The aim of this 2-step approach is to explore and to maximize the potential of elaborating a comprehensive assessment technique of social impacts based on a life cycle and value chain approach.

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Session 3

Using UNEP-SETAC and Social Hotspots Database (SHDB)

Social LCA data collection and assessment over the entire supply chain in a project in Chile in the agrofood sector

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In an ongoing project with 12 small and medium enterprises in the agrofood sector in Chile, a comprehensive sustainability assessment of products over the entire supply chain is performed. Companies are producing e.g. orange juice, olive oil, rice, pita bread, but also detergents. The assessment includes social impacts and benefits related to the products, and this will be the focus of the presentation.

Meanwhile, the indicator selection is finished, and the data collection is ongoing. Over summer, the results will be compiled, and shared with the companies.

The presentation will present and motivate the developed indicator set and will then focus on the practical case study. Experiences in the data collection will be reported, and an assessment of the various investigated supply chains will be provided, in terms of individual hot spots and also in terms of a comparison of various supply chains.

As an outlook, an overview is given on how to integrate the social assessment data in an overall sustainability assessment, and also, on a more practical level, how the companies involved use the social assessment.

Integration of social LCA with sustainability LCA: a case study on virgin olive oil production

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1. Context and scope

Olive oil is increasingly consumed worldwide as a result of its organoleptic properties. Its consumption increased from 2.7×10^3 tons per year between 2000 and 2007 to 2.9×10^3 tons between 2008 and 2012 (COI 2012a). The production of olive oil in the European Union has decreased from more than 78 % of the world's olive oil production between 2000 and 2007 to approximately 73 % between 2008 and 2012 (COI 2012b). The olive oil sector represents a strategic sector in European Union countries that faces emerging competition with the arrival of new producers from other countries. The major competitors include Argentina, the USA, Chile and Australia (Salomone and Ioppolo 2012; COI 2012b). These new producers use intensive and highly mechanized methods that increase yields and reduce operational costs.

On the other hand, olive oil production sector faces environmental issues such as water scarcity, fertilizers and chemicals use or fossil fuels consumption. Another crucial issue concerns waste management. Eighty percent of the mass of olives is composed of olive pulp and stones. Thus, the extraction process gives four times more waste than oil. The composition of the waste products depends on extraction technologies including press, 2-phase or 3-phase systems (Cinar and Alma 2008). They contain phytotoxic chemical compounds and, in particular, wastewater (Roig et al. 2006). As a consequence, environmental life cycle assessment (ELCA) has been applied to olive oil for more than ten years in order to identify environmental hotspots and to propose recommendations to limit environmental impact (Salomone et al. 2010).

Finally, the future of LCA methodology is now oriented to life cycle sustainability assessment (LCSA) (Guinée et al. 2011). This new methodology is based on the integration of ELCA, life cycle costing (LCC) and social LCA (S-LCA). One of the difficulties of such integration is the amount and the heterogeneity of impacts indicators. The present study proposes to inform the discussion by applying social LCA to virgin olive oil production in a life cycle sustainability assessment.

2. Main text

Material and methods

The integration of social LCA into a LCSA was carried out following the four steps method according to the UNEP/SETAC guide (2009). Among the solutions to deal with the three aspects of sustainability, the integrated method was chosen. It relies particularly on the use of only one inventory for economic, social and environmental aspects. This choice was made in order to facilitate the link between the three spheres of sustainability. LCSA was performed using the sum of the three methods (ELCA, LCC and SLCA) without weighting, to avoid compensation between positive or negative impacts on the three sustainability pillars (Klöpffer 2008).

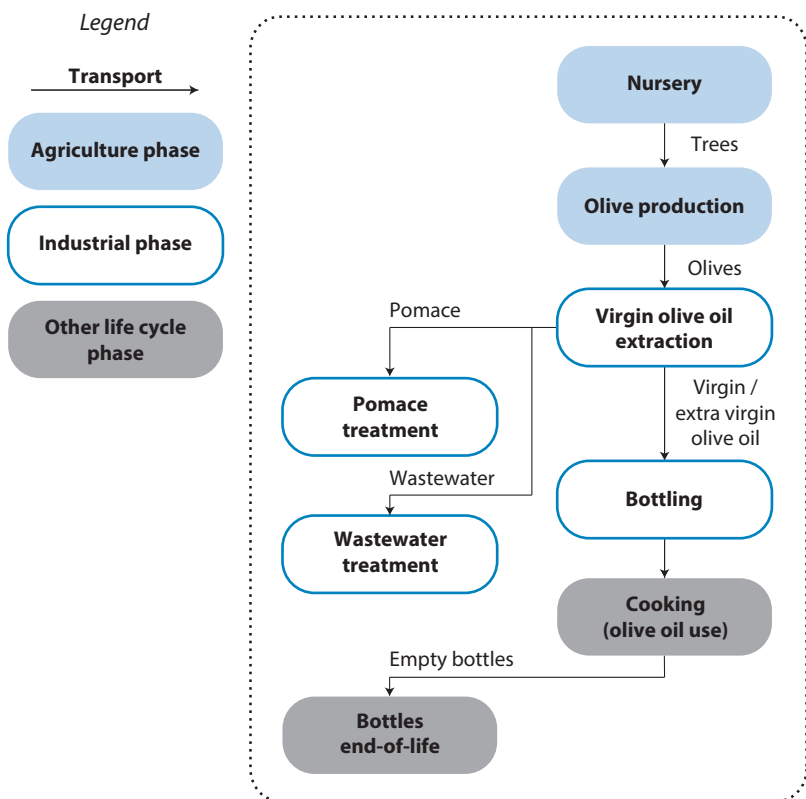


Figure 1: System under study

Goal and scope definition

The objective of the study is to evaluate impact on sustainability of the system of virgin olive oil production. The functional unit of the system is to produce 1 L of virgin olive oil.

System boundaries include the following phases: transport of phytosanitary products, olive production (including nursery) and transport to mills, virgin olive oil extraction, waste (water and pomace) management, transport of empty new bottles, bottling, distribution and disposal of used bottles. All phases are organized into three groups: agricultural, industrial and others (figure 1).

All flows and impacts are allocated to the virgin olive oil. When recycling or incineration leads to energy recovery, no avoided emissions are calculated. In terms of life cycle cost evaluation, externalities from environmental cost remediation do not count. Only direct costs are included. The LCSA here applied is attributional. Social inventory data only come from the enterprises of the sector. No social data from database are included.

Life Cycle Inventory

Environmental and economic data were taken from Busset et al. (2012). Two kinds of environmental and economic data were collected during the inventory: direct data from professional or experts and indirect data from calculation or from database. Direct data were gathered through visits and interviews with 10 olive mill directors for extraction, bottling and waste treatment processes (Busset et al., 2012). For olive production phase, data from 11 olive cultivators were given by expert from the "Centre Technique de l'Olivier" (CTO), an association involving all the professionals of the French olive sector (Busset et al., 2012). The CTO also provided statistics about olive oil sector production.

Social direct data correspond to social indicators included in the UNEP/SETAC guidelines (2009). The most relevant with regard to the sector were selected. Table 1 present the main inventory data for the three aspects.

Table 1: Inventory data for olive production and olive oil extraction (average)

Direct data	Unit	Olive production	Olive oil extraction
Diesel	kg/year	0.052	0.00020
Electricity	kWh/year	0.015	0.39
Water	m3/year	0.59	0.0022
Gasoline	kg/year	0.0032	-
Fertilizers	kg/year	1.0	-
Pesticides	kg/year	0.0099	-
Number of fatal accidents per year	#/year	0	0
Preventive measures	no unit	yes	yes
Emergency protocols exist regarding accidents & injuries	no unit	yes	yes
Preventive measures and emergency protocols exist regarding pesticide & chemical exposure	no unit	yes	no
Appropriate protective gear is required in all applicable situations	no unit	yes	yes
Number of full-time jobs	#	1	2
Quality of information/signs on product health and safety	no unit	enough	enough
Sector efforts in technology development (level of automation)	#	0	0
Relevance of the considered sector for the local economy	%	100	100
Number of consumer complaints to the company	%	100	50
Certifications	no unit	none	none

Because of the qualitative or semi-quantitative nature of some social data, social inventory cannot be expressed by functional unit. Furthermore, qualitative data needs to be transformed in order to become semi-quantitative or quantitative. The factors or scale used for data transformation were inspired by the work of Foolmann and Ramjeeawon (2013) and Hsu et al. (2013) (Table 2).

Table 2: Transformation of qualitative social indicators from inventory into semi-quantitative indicators

Indicator	Value for midpoint category
Number of fatal accidents per year	1 if number of accidents is 0, -1 if it is ≥ 1
Preventive measures	-0 if no, 1 if yes
Emergency protocols exist regarding accidents & injuries.	-0 if no, 1 if yes
Preventive measures and emergency protocols exist regarding pesticide & chemical exposure	-0 if no, 1 if yes
Appropriate protective gear is required in all applicable situations	-0 if no, 1 if yes
Number of full-time jobs	1 if >0 , 0 else
Sector efforts in technology development (level of automation)	0 if no, 1 if yes
Relevance of the considered sector for the local economy	1 if taxes paid, 0 else
Number of consumer complaints to the company	1 if = 0 et -1 if ≥ 1
Quality of information/signs on product health and safety	0 if not enough, 0,5 if enough, 1 if more than enough
Percentage of workforce hired locally	0 between 0 % and 20 %, 1 between 20 % and 40 %, 2 between 40 % and 60 %, 3 between 60 % and 80 %, 4 between 80 % and 100 %
Employees with higher education	0 between 0 % and 20 %, 1 between 20 % and 40 %, 2 between 40 % and 60 %, 3 between 60 % and 80 %, 4 between 80 % and 100 %
Employees with basic education	0 between 0 % and 20 %, 1 between 20 % and 40 %, 2 between 40 % and 60 %, 3 between 60 % and 80 %, 4 between 80 % and 100 %
Certifications	0 if none, 1 else.

Life Cycle Impact Assessment

Environmental impact calculations are made using ILCD 2011 and ReCiPe 2008 methods for eighteen chosen midpoint impact categories: Climate Change (IPCC GWP 100a), Human toxicity, cancer (UseTox), Human toxicity, non-cancer (UseTox), Photochemical Oxidant Formation, ReCiPMidH, Acidification, Eutrophication, terrestrial, FreshWater eutrophication, ReCiPMidH, Marine eutrophication, ReCiPMidH, Ecotoxicity (UseTox), Abiotic depletion (CML 2001), Resource depletion, Water, Ozone Layer Depletion, Ionizing radiation, human health, Particulate matter/respiratory inorganic, Ionizing radiation, ecosystems, Agricultural land occupation, Urban land occupation and Natural land transformation.

Economic midpoint category is unique and corresponds to life cycle cost for 1 functional unit.

Social midpoint categories corresponding to selected indicators (or impacts sub-categories) are taken from UNEP/SETAC (2009) guidelines for SLCA: Health and Safety at work, Technology development, Health & Safety of consumer, Local employment, Promoting social responsibility.

Results & discussion

Impacts of olive production are higher than virgin olive oil extraction in twenty-one out of the twenty-four midpoint categories. Only one environmental impact is mainly caused during extraction phase: agricultural ionizing radiation on human health, due to the French electricity production mix. The most impacting processes are fertilization and phytosanitary treatment (pest control and disease control). Pest control has the most important impact (97 %) for ecotoxicity due to the use of pesticides and particularly dimethoate. Harvest contributes to 41 % of total cost of olive production, even whether it does not contribute significantly to environmental categories. This is mainly due to the high workforce costs in France.

Social impacts are higher in two out five categories and equals in the three others categories. Furthermore, the deviation is less than 15 %. That means that social impacts are similar between the two main phases of the life cycle of olive oil production. Absolute social results are not interpretable here (figure 2 below).

From this case study, some limits appear. First, social impacts only concern gate-to-gate boundaries because the lack of data on the other phases of the life cycle. Then, the interpretation of social impacts must be clearly explained because the highest impact corresponds to the best social solution. A hotspots identification of social impacts do not appear relevant because, for it is not possible to express results per functional unit. Furthermore, for instance, the enterprise indicators such as number of employees can not be compared because the need of workforce is different from a company to another, depending on its size, its strategy, etc. Even if in theory, social LCA seems to be applicable, in practice, results are not enough precise and complete to be usable. This conclusion is in line with the recent review by Macombe et al. (2013).

Conclusion

A life cycle sustainability assessment of virgin olive oil production was carried out. It emerged that production of olives was the most impacting phase for the most environment, social and economic midpoint categories, in accordance to previous LCA studies on olive oil. The integration of social LCA with environmental LCA and LCC appears possible but difficult due to the singularity and the availability of social data. Main results were the difficult choice of social indicators and the lack of social data (problem of confidentiality and lack of more complete social database). The study also

showed that it was easy to make a single inventory with economic and environmental data but not with social data.

Further investigation could also complete the integration in order to reduce the number of indicators. Indeed, as a tool for decision makers who are not able to deal with more than few indicators, a multicriteria analysis is needed. This study finally raised the major and emergent issue of the integration of social sciences and engineering.

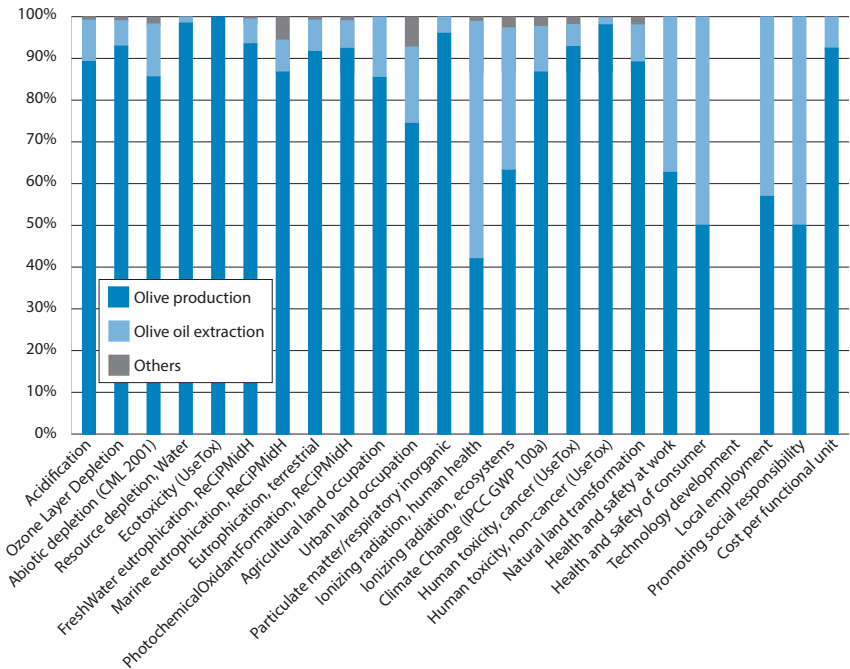


Figure 2: Comparison of impacts between olive production phase and virgin olive oil extraction

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Can conducting a social LCA helps meeting major social responsibility standards requirements?

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1. Abstract

There are a number of influential social responsibility standards and regulations that were published in the recent years (eg. UN Guiding principles on Business and Human Rights, ISO 26000, GRI G4, California Transparency Act, Dodd-Frank act section on conflict minerals). One characteristic of these standards and regulations is to require or incentivize companies to assess and report about their supply chains risks and impacts. Many organizations are assessing and deciding about which tools and processes they will use to meet the new criteria.

Social Life Cycle Assessment is a technique developed to make operational the assessment of supply chains social impacts (UNEP-SETAC, 2009). There is a need to specify and explain how and to what extent Social LCA can help organizations fulfill standards and regulations requirements. In this paper, we will present the sections of these standards and regulations which refer to supply chains and discuss how Social LCA can be applied to support organizations in the assessment and reporting of their supply chains social risks, impacts and benefits. We will illustrate the discussion with an example.

2. CSR context

The Guidelines for Social Life Cycle Assessment (UNEP-SETAC, 2009) has positioned Social LCA as a tool for Corporate Social Responsibility (CSR). Indeed Social LCA applies a framework to assess social sustainability dimensions within the sphere of a company's product life cycles. Capron and Quairel-Lanoizelée (Capron et Quairel-Lanoizelée, 2004) considers that CSR is defined as the appropriation and implementation of the logics and principles of sustainable development to the business domain. Many consider CSR key distinguishing feature as the voluntary nature of the initiatives companies undertake in its name (Blowfield and Frynas, 2005). Accordingly, a vast number of voluntary standards and initiatives were developed or launched in the past decade (eg. ISO 26000, Global Reporting Initiative). However, we

are also beginning to see the rise of new governmental regulations that strengthen the pressure on companies to act in regard to supply chains social responsibility issues may they concern humans or workers rights.

Even though the division of production in multiple international steps is probably the most significant change in international trade of the past 40 years (Robertson et al., 2009), the question of supply chain social responsibility is still relatively new (Brammer et al., 2011). Starting from the 1990's with the work of scholars and activists such as Dara O'Rourke (O'Rourke, D. 1997) global attention was drawn on the plight of apparel and footwear workers in developing countries and the inequalities in wealth distribution. To address criticisms, brands turned to increased social auditing and monitoring. 20 years later, NGO's, auditing organizations, trade unions and Intergovernmental organizations reports unprecedented number of non-compliance in supply chains (eg. Impactt, 2014, Clean Clothes Campaign 2005, AFL-CIO, 2013). Now, it is also a fact that globalization has never been as intense as it now is with the World Economic Forum documenting a steep raise in intermediary inputs international trade (WEF, 2012). Even when recognizing the surge in globalized inputs, the ineffectiveness of traditional or even "improved" social auditing practices in resolving social compliance issues is no more disputed (Locke, 2014). This exacerbates the need to understand better supply chains social impacts and develop new strategies to fully respect human and worker rights.

One way that CSR can be viewed as highly influential is by its success in institutionalizing (at least within Fortune 1000 companies) stakeholder management. Stakeholder theory emerged in 1984 as a new conceptual framework for management and establishes that stakeholders have legitimate interests in corporate, and more broadly, organizations activities (Freeman, 2004). CSR voluntary nature and stakeholder theory have historically gone hand in hand. As a consequence most voluntary standards are or were developed within multi-stakeholder initiatives or international initiatives involving extensive stakeholder consultations. Thus we have three moving pieces to our puzzle, the intensification of globalization, the multiplication of social impacts (both positive and negative) and the recognition of stakeholders' legitimacy.

3. Voluntary Standards requirements

In this paper we will review how some of the most prominent voluntary standards suggest that companies deal with and report on supply chains social sustainability. There are two voluntary standards that are especially influential: the United Nations Business and Human Rights Framework and the Global Reporting Initiative (GRI) G4. A number of other standards and sustainability rating schemes would also be relevant to include and add to this analysis such as ISO 26 000 but the scope and influence of the two above is motivating the choice.

Guiding Principles on Business and Human Rights

Former Special Representative of the United Nations Secretary-General, Professor John Ruggie, developed the UN Business and Human Rights framework over 6 years. The development has included in-depth research; extensive consultations with businesses, Governments, civil society, affected individuals and communities, lawyers, investors and other stakeholders; and the practical road-testing of proposals.

The United Nations Human Rights Council endorsed the Guiding in 2011 hence establishing the Guiding Principles as the global standard of practice that is now expected of all States and businesses with regard to business and human rights. While they do not by themselves constitute a legally binding document, the Guiding Principles elaborate on the implications of existing standards and practices for States and businesses, and include points covered variously in international and domestic law (United Nations, 2012). The Guiding Principles were developed to put into operation the “Protect, Respect and Remedy” Framework presented by the Special Representative to the United Nations in 2008. This three-pillar Framework consists of:

- The State duty to protect human rights
- The corporate responsibility to respect human rights
- The need for greater access to remedy for victims of business-related abuse.

One of the key aspects of the Guiding Principles is its focus on due diligence. Human rights due diligence is defined by the Guiding Principles as – a business’s ongoing processes for assessing its actual and potential human rights impact, integrating and acting upon its findings, tracking its responses and communicating how its impact is addressed (United Nations, 2012). Human rights due diligence should cover adverse impact that the business may cause or contribute to through its own activities, or which may be directly linked to its operations, products or services by a business relationships. Consequently, these activities and business relationships set the scope of human rights due diligence.

The Guiding Principles describe three basic ways by which enterprises can be involved in adverse human rights impact:

- (a) Enterprises may cause the impact through their own activities;
- (b) Enterprises may contribute to the impact through their own activities—either directly or through some outside entity (Government, business or other);
- (c) Enterprises may neither cause nor contribute to the impact, but be involved because the impact is caused by an entity with which it has a business relationship and is linked to its own operations, products or services.

Each of these three basic scenarios has different implications for the nature of an enterprise’s responsibilities. It is understood that for multi-tiered and complex value chains where companies entertain thousands of suppliers even in their first

tier, it is very challenging to assess every individual business relationship. However, according to the Guiding Principles, this does not reduce companies' responsibility to respect human rights. Hence, not knowing about human rights abuses linked to its operations, products or services is unlikely by itself to satisfy key stakeholders, and may be challenged in a legal context (United Nations, 2012).

If due diligence on every individual relationship is impossible, The Guiding Principles explains that "business enterprises should identify general areas where the risk of adverse human rights impacts is most significant, whether due to certain suppliers' or clients' operating context, the particular operations, products or services involved, or other relevant considerations, and prioritize these for human rights due diligence" (United Nations, 2012). This would include, for example, agricultural products sourced from suppliers in an area known for child labour; security services provided by contractors or forces in areas of conflict or weak governance and rule of law etc.

GRI G4

Created in 1997 by the US based non-profits CERES and Tellus Institute, with the support of the United Nations Environment Programme (UNEP), the Global Reporting Initiative (GRI) is an organisation promoting "sustainability reporting as a way for organizations to become more sustainable" (globalreporting.org). GRI is mostly known for the reporting framework it developed: a holistic set of economic, social and environmental indicators. The fourth generation of the reporting Guidelines was published in 2013. The Global Reporting Initiative considers that: "A sustainability report conveys disclosures on an organization's impacts – be they positive or negative – on the environment, society and the economy. In doing so, sustainability reporting makes abstract issues tangible and concrete, thereby assisting in understanding and managing the effects of sustainability developments on the organization's activities and strategy"(GRI G4, 2013).

At the core of preparing a G4 sustainability report is a focus on the process of identifying Material Aspects. G4 defines Material Aspects as issues "that reflect the organization's significant economic, environmental and social impacts" and incentivizes reporting organisations to only provide information on those aspects. Therefore, with G4, GRI simultaneously try to limit the issues reported on and enlarge the scope of the value chain for which reporting is desirable. Organisations are encouraged to conduct a "materiality assessment" to identify the significant sustainability impact and the value chain links they should be focusing on regardless of whether those impacts are within direct control. Whether companies have a good understanding of their value chain sustainability impacts or need to build this exercise into their strategy, materiality assessments are a step forward helping companies to make sense of the bigger picture of sustainability performance across all their activities.

The GRI's understanding of material aspects similarly narrows the universe of issues that a company reports on to those most critical to both the company and its stakeholders. On the other hand, with materiality at the center the "boundary attributes or scope"

of the material issues are becoming more fluid. This means that companies must not only consider what, but where an issue is relevant across the organization and its value chain (which sites, subsidiaries, countries, suppliers, products, etc.). It also means that a company may report a different boundary for different issues. For example, child labor could only be reported on from the perspective of the supply chain or specific buying categories or geographies in the supply chain, while greenhouse gas emissions could be reported on from the perspective of the company-owned fleet or the downstream impacts associated with product use. GRI G4 requires a section of the company sustainability report to provide a description of key impacts, risks, and opportunities, as defined by national laws and relevant internationally recognized standards.

This section should include:

- A description of the significant economic, environmental and social impacts of the organization, and associated challenges and opportunities (including the effect on stakeholders' rights as defined by national laws and the expectations in internationally recognized standards).
- An explanation of the approach to prioritizing these challenges and opportunities.
- Key conclusions about progress in addressing these topics and related performance in the reporting period (Including an assessment of reasons for underperformance or over-performance).
- A description of the main processes in place to address performance and relevant changes.

Table 1: GRI G4 indicators reflecting this new approach to sustainability reporting

G4-LA15	Significant actual and potential negative impacts for labor practices in the supply chain and actions taken
G4-HR11	Significant actual and potential negative human rights impacts in the supply chain and actions taken
G4-SO10	Significant actual and potential negative impacts on society in the supply chain and actions taken

Table 1 presents the indicators of G4 representing this novel approach. A big potential gain with the increased importance and new approach to determining materiality is a more targeted and meaningful identification of relevant issues. One potential concern around materiality is that companies become too selective, screening out issues that they should be reporting. Deciding on a realistic list of material issues is a critical component of the G4 reporting process.

4. What S-LCA has to offer?

The two voluntary standards covered calls for companies to implement what can be considered in LCA terms a “hotspot” assessment process within their supply chains. Even though these standards apply to “a company” and not a product they still mandate for companies to investigate the most “material” or “impactful” business relationships may they be direct or indirect and identify the issues at stake as well as their locations.

Social LCA as a tool can enhance significantly the strategies currently implemented by companies or governments to fulfill these requirements. The main strategies currently applied are desk research, stakeholder surveys and materiality matrices. Because of the comprehensive scope of the Guidance Principles and G4, companies are asked to holistically understand their supply chains risk. Anyone familiar with decision analysis and the bounded rationality theory (Simon, 1996) realizes that the human brain is not designed to hold and process all the information relative to a company supply chains potential social negative impacts without help. In that sense, even well intentioned stakeholders input will skew the reality simply by not being able to hold and process such complex information. Even though supply chain due diligence and materiality assessment are now strongly emphasized, methodologies to attain the objectives sought are mostly unknown by users or at their early stage of utilization as demonstrated by a Shift report (Shift, 2012) or a Ernst & Young survey revealing that just 48 per cent of UK firms carry out due diligence on their supply chain, with 30 per cent admitting they had not carried out any checks whatsoever (Supply management, 2013). Social LCA can provide three critical dimensions to materiality assessment and due diligence summarized as methods, models and data.

Methods

Methods are needed to enable the assessment of risks and performances throughout the value chain in a comprehensive, consistent but manageable way. Through the UNEP-SETAC Guidelines for Social LCA of products and the complementary methodological sheets (UNEP-SETAC, 2013) the field of Social LCA established a framework building on the ISO 14040 and 14044 LCA standards. Through conferences, published journal articles, seminars and industry group publications (Pré, 2014), the methods are spreading, evolving and gaining in maturity.

The Life Cycle Inventory and Impact Assessment methods developed within the field of Social LCA have the potential to bring structure, credibility and consistency to due diligence process and supply chain materiality assessment.

Models

Models are needed to inform about the supply chain activities, linkages and location. While a large number of companies have still very limited information on their

suppliers (eg. facility locations), let alone second or third tiers suppliers, LCA and Social LCA models enable to by-pass this information gap by using trade or process models.

Social LCA requires geographic location information (UNEP-SETAC, 2009) motivating the use of Global Input-Output models. Multiregional IO models availability is increasing and count the World Input-Output Database (WIOD), the Global Trade Analysis Project (GTAP) derived model, Exiobase and Eora. At the present time the model available which provides the highest number of countries and sector consistency is GTAP. As the demand is increasing, process-based models are also integrating location information or seeking to hybridize with a multiregional IO model.

Data

Data are needed to support assessments by providing generic and site-specific information that will allow identifying hotspots and assessing performances. Social LCA requires its own data addressing relevant social issues. The UNEP-SETAC Guidelines on Social LCA include a flexible list of impact subcategories that cover issues mandated by most standards.

With a first comprehensive Social LCA data source, the Social Hotspots Database (Benoit Norris et al., 2013) the field of Social LCA can deliver extensive hotspots assessment at the level of the company, a company division or a product category.

Example

Owens Corning, a building material company headquartered in the US was carrying an initial (first phase) due diligence process of its own operation supply chains. It collected data on operation revenues, sectors and locations which were used to create a first high-level supply chain model. Using the Social Hotspots Database, they were able to identify their most at risk operation supply chains links on each relevant issue. They were also able to calculate process contributions in order to drill-down to the production activities contributing to the highest share of the impacts. These initial results enabled them to prioritize a second phase involving more precise modeling and data collection.

5. Discussion and conclusion

With regulations implemented in the US such as the California Transparency Act, the Dodd-Frank act section on conflict minerals and the 2013 Executive order on Human Trafficking, due diligence is also becoming a compliance issue that is directly affecting business. Which such laws also being in development or under review in the UK, Switzerland, EU, Canada and beyond, there is no question whether due diligence and materiality assessments are relevant for Social LCA.

Social LCA has also specific characteristics making it a tool of choice for companies implementing such processes. While stakeholder engagement and surveys are necessary components of a materiality assessment and due diligence process, a science-based process is also needed in order to bring consistency and comprehensiveness to the results. Since its attributes are so greatly needed in the business and societal domains there are good reasons to discuss as a Social LCA community how we can make Social LCA as effective, understandable, reliable and user-friendly as it needs to be in order to be broadly utilized.

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Social Life Cycle Assessment for Open Pit Gold Mining in Colombia: a case study in Tolima (Colombia)

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1. Context and scope

Cajamarca (Tolima) is a village full of natural resources, especially water-related ones. Its agricultural production for the first quarter of 2008 reached 3 153 tons of food, which reached main supply centers at the national level [1]. Meanwhile, in 2006 a multinational company established the largest open-pit gold mining project in Colombia there. A production of 26.8 million ounces was estimated [2, 3, 4, 5]. While the project is currently in its pre-feasibility phase and would be expected to begin in 2019 [2], so far it has generated local and national concern from stakeholders, due to controversy about its environmental and social impacts.

As a result, the project has an environmental license from national environmental authority, but lacks a social license to operate (as defined by [6]) from local stakeholders, including local authorities. Ideally, one would expect the company responsible to involve stakeholders in the preliminary decision-making processes and local development programs. However, at present, although the company has programs for social responsibility and community activities, this study found stakeholders were divided about the open-pit gold mine. The main concerns expressed by the community include: the effect on water bodies (supply and quality); the increase in the local cost of living; and increased pressure on the community. Moreover, a series of disagreements was identified between stakeholders with conflicting of interests (environmental protection, strengthening local community, governance, etc.).

2. Main text

This study was done through integrating the traditional Life Cycle Analysis (LCA) methodology and the one proposed by UNEP/SETAC: Social Life Cycle Analysis (S-LCA) [7]. Its main goal was to establish the social and environmental impacts associated with open-pit gold mining. An ounce of extracted gold was selected as the functional unit. The scope considered ranged from raw materials extraction (mining) to processing.

Marketing and disposal of the product were not considered. This research was divided into two phases. First, the social impact was determined using stakeholder theory and social impact assessment, adapting the social impact study of biodiversity and REDD+ manual [8, 9, 10]. Thirty-six stakeholders participated through personal interviews and surveys. Official documents from stakeholders (both local authorities and the multinational company) were also reviewed. Second, the most likely scenario of resource exploitation data was used to conduct the assessment. For this, models presented by the company were considered as well as interviews done to internal stakeholders. The company did not provide detailed information for the development of the environmental study, however, which is why the data from secondary sources was used, thereby limiting the initial inventory.

Conflicts among stakeholders were evident. First, there was conflict between the Ministry of Environment and Sustainable Development (national environmental authority) and the Regional Autonomous Corporation of Tolima (local environmental authority). Second, there was conflict between local authorities and the multinational company. Similarly there was conflict between the company and Major Groups and Stakeholders (MGS) – environmentalists, educational institutions, farmers, youth and women – who have expressed their dissatisfaction with the project through written communication, protests and other statements through the media.

Other results of this study are related to the lack of partnership between the multinational company and stakeholders in general. While the company has social responsibility programs and significant investments in social programs (education, health, entrepreneurship, etc.), local community and other stakeholders alleged they have not taken part in such a process. An opportunity for the company was thus identified to change its social responsibility model from “share the value created” to “create shared value” [11].

The different groups who disagreed with the project, expressed concern over issues such as the quality and availability of water resources, air and soil pollution, vegetation affectation, as well as a negative socio-cultural impact, related to reduction of life quality for local communities, represented in terms of an increasing cost of living, and difficulties with health and work-life balance.

As a second result, the environmental dimension of Life Cycle Assessment, SimaPro 8 (Academic Edition) software was used. Databases were adjusted to the Colombian context, specifically in the energy matrix, using the values reported by [12]. In the inventory phase, information collected was discussed as by [13].

The main findings in the impact assessment focuses on the process of recovery with electricity, which is related to the amounts of sodium cyanide and hydrochloric acid used during the process. Human health, ecosystem capacity and climate change were categories with greatest negative impact. Based on the above, one recommendation to the multinational company is to pay special attention in terms of human toxicity and respiratory organic agents to both workers and the surrounding community in the area of future operating conditions. Implementing prevention projects at CSR

programs could reduce some of the impacts on this dimension. This would include: i) incidence in workers of: silicosis, pneumoconiosis and Buruli ulcer; ii) incidence in the local community of: asthma, inhalation of arsenic, sulfur poisoning, abortions, increased congenital diseases and malnutrition; and iii) incidence in the community of problems associated with intestinal diseases by consuming poisonous traces of food from crops in the area of influence.

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ASCV comparative des filières céréalières en Wallonie (Belgique)

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1. Contexte et problématique

En Wallonie, plus de 60 % des terres arables sont emblavées avec des céréales (DGSIE, 2011). Par ailleurs, le secteur de l'industrie des aliments pour animaux, qui joue un rôle considérable dans le secteur de la première transformation wallonne des céréales, est encore très peu analysé. Ainsi, 45 % du blé wallon est destiné à l'industrie des aliments pour animaux, 25 % à l'industrie des biocarburants, 10 % à la meunerie et, enfin, 1 % à la malterie (Delcour A. et al., 2014). Au vu de la place occupée par cette culture sur le territoire wallon, des changements liés à la nouvelle Politique Agricole Commune et des attentes de la société vis-à-vis du secteur agricole, il nous semble plus que nécessaire de pouvoir analyser les impacts socio-économiques des filières céréalières wallonnes. A l'heure actuelle, il existe peu de cas d'études traitant de filières agro-alimentaires dans les pays industrialisés. Devant ces différents enjeux, comparer les impacts sociaux et environnementaux, projetés à l'horizon 2030, de diverses voies de valorisation des céréales prend tout son sens et ce afin de connaître les points critiques auxquels il y aurait lieu d'être attentif. Afin d'atteindre cet objectif, quatre scénarios de valorisation ont été définis à l'horizon 2030. Le premier, le tendanciel, prolonge les tendances de ces 15 dernières années, le deuxième, le « stratégique », optimise les choix sociaux, économiques et environnementaux des filières, le troisième, le « relocalisation », se centre sur l'autonomie d'approvisionnement de la Wallonie, ainsi que sur le développement de nouveaux débouchés. Enfin, le quatrième, le « globalisation », se veut ouvert avant tout sur le marché de l'importation de produits à faible valeur ajoutée, tandis que les productions à haute valeur ajoutée sont encouragées sur le territoire wallon (Van Stappen F. et al., 2014).

2. Texte principal

Sur base de l'étude des flux céréaliers wallons et de l'établissement de scénarios de valorisation à l'horizon 2030, une ASCV et une AECV ont été menées afin d'évaluer les impacts socio-économiques et environnementaux des différentes voies de valorisation des céréales. La prise en compte des impacts socio-économiques est

d'ailleurs une thématique d'intérêt croissant en Belgique, puisqu'en 2003, un label social a été créé afin de caractériser les produits et les services belges (Spillemaeckers S., 2007). En ce qui concerne le travail développé pour l'ASCV, les divers acteurs de la filière ont été fortement impliqués, comme suggéré par (Mathe, 2014), et ce afin de pouvoir identifier les catégories d'impact pertinentes à leurs yeux mais également afin de pouvoir définir les données comparables entre entreprises. De plus, au niveau de la Social Hotspot Database, il n'existe pas encore de données spécifiques à la Wallonie. Or, au niveau des filières céréalières la production est essentiellement centrée en Wallonie alors que la transformation a lieu en Flandres (Delcour A. et al., 2014). Il était donc important de pouvoir dissocier les deux régions lors de l'analyse.

L'objectif de l'ASCV est donc d'étudier les impacts socio-économiques de filières de valorisation des céréales à l'horizon 2030. Le système s'étend de la production à la première transformation. Etant donné l'étendue des données à recueillir, il n'a pas été possible d'aller jusqu'à l'étape de consommation. Les sous-catégories d'impact étudiées sont l'emploi local, la sécurité sur le lieu de travail et la répartition de la valeur ajoutée. Les parties prenantes sont les agriculteurs, les entreprises et les travailleurs. Ces choix se sont basés sur la méthodologie UNEP/SETAC (UNEP/SETAC, 2009), sur les priorités mentionnées dans diverses politiques, sur la pertinence de leur utilisation, ainsi que sur la disponibilité des données. Ils ont été validés par les représentants des divers acteurs. Cette démarche de validation par les acteurs permet de s'assurer de l'intégration de thématiques qui ont un sens à leurs yeux (Mathe, 2014). Les données nécessaires à la caractérisation de ses sous-catégories d'impact ont été obtenues sur base d'interviews auprès des producteurs et des transformateurs, ainsi qu'au départ sur les données comptables des entreprises (BCE, 2013). Les interviews auprès des producteurs incluaient la méthodologie Bilan Travail (INRA-SupAgro-Institut de l'Élevage, 2008), afin de connaître le temps disponible pour l'agriculteur en dehors de l'activité agricole, c'est-à-dire pour des activités familiales, ses loisirs, etc.

Au niveau des entreprises, en matière de sécurité, les données étant difficiles à obtenir, il a fallu se baser sur des indicateurs qualitatifs (mesures non obligatoires mises en place ou non, méthode d'apprentissage de la sécurité au sein de l'entreprise, etc.) afin d'évaluer la situation. Au niveau des travailleurs, l'indicateur de Shannon a été utilisé pour résumer l'information relative à la diversité existant au sein de l'entreprise au niveau de l'âge de ses employés, ainsi que de leur niveau de formation de base. Pour les travailleurs, d'autres indicateurs ont également été intégrés, tels que le nombre de kilomètres entre le domicile et le lieu de travail, les salaires, le nombre d'heures de formation, le pourcentage de temps partiel, etc. En ce qui concerne les entreprises, des indicateurs tels que les moyens alloués aux formations, le nombre d'emplois, la relève du personnel, etc., ont également été pris en compte. Lorsqu'une sous-catégorie d'impact est caractérisée par plusieurs indicateurs, ces divers indicateurs peuvent être agrégés sur base d'une consultation des stakeholders.

L'analyse des performances des différents groupes considérés pour ces différents indicateurs et/ou sous-catégories d'impact se base sur une comparaison des médianes entre entreprises. Un diagramme de Kiviat (AGECO, 2012) peut alors être mobilisé afin

d'illustrer les différences existant entre les groupes considérés et ce en partant tant des indicateurs de base (figure 1) ou des sous-catégories d'impact suite à l'agrégation des indicateurs correspondants.

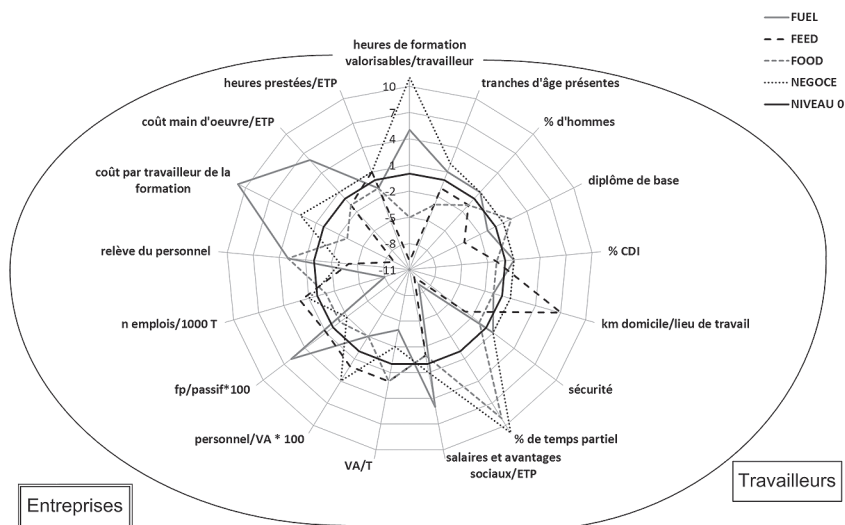


Figure 1 : Comparaison des indicateurs de performances socio-économiques liées à différentes filières d'utilisations des céréales en Wallonie

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Social LCA: interest, curiosity, scepticism and challenges

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1. Context and scope

In the last years, it is increased the interest towards sustainable production. Society is more and more aware that products could have negative influence not only for the environment, but also for the society. That is why there is a need for methodologies assessing social performance of products, such as social LCA (SLCA).

Our research institute, traditionally specialized in E-LCA, is currently involved in three projects (see at projects' reference in the bibliography) where the goal is to assess social impacts of respectively textile, nano-cellulose and ligno-cellulosic products (bio chemicals) in Norway.

The scope of these projects is to increase our knowledge on this topic through literature review and state of the art on SLCA, develop a methodological framework for social LCA analysis, identify both the hotspots and relevant indicators for each examined product and when possible testing these indicators with stakeholders.

Social risks for textile and biochemical products are presented by social hotspot analysis using the social hotspot database (SHDB) as main screening tool.

In the main text of this abstract, we will describe the phases of methodological framework development for SLCA, the challenges met in performing SLCA in general and specific for the three case studies and we will present some results.

2. Main text

In the first phase of the methodological framework development, a literature study was carried out by downloading scientific article and report related to the theme of social LCA, social indicators and sustainability in general and related to the examined products. The selection of the most relevant articles addressed to the goal of the study was challenging, due to the lack of social LCA case study specific for these products. Many articles cited the words sustainability, social and socio-economic aspects, in connection with LCA, although only to introduce the relevance of LCA for the society.

The diversity of terminology utilized in different literature sources (sLCA, social LCA, societal LCA etc.) has increased the complexity of the literature review.

In phase 2, we selected social indicators according to different scientific sources. This selection was performed by literature research as described in phase 1 followed by consulting products related studies, if present.

In phase 3, we developed a questionnaire for data collection, testing the proposed selection of social indicators with stakeholders. It was possible to discuss this selection only for biochemical products.

In the textile case study, due to short-term research project and confidentiality issues (e.g. it was denied to know the source of sub-supplier of synthetic material) we could not test our choice.

In the nano-cellulose case, the application of this nano-material is currently only at laboratory scale, so it is problematic to identify which could be the social impacts. Hence, the next step will be to identify the future social categories and impact influenced by the production and consumption of this product when it will be upscale at industrial scale.

The data collection was very challenging phase, because of difficulties to get in contact with the stakeholders, find right experts, confidentiality matters and very time demanding.

Thus, we have decided to use the social hotspot database (SHDB) (www.socialhotspot.org), developed by New Earth for evaluating the risk of social impacts along the supply chain at country level and specific sector (CCS) (Benoit-Norris et al., 2012).

In the case of textile, we focused on the stakeholder category “worker” in the following sectors:

- a) textile;
- b) wool products and
- c) chemical, rubber plastics.

We assessed three social themes linked to the issue “labor right and decent working conditions”:

- 1) child labour: single issue “risk of child labour in sector (qualitative)”
- 2) poverty: single issue “risk of wages being under 2 \$ per day”
- 3) working time: single issue “risk of excessive working time”

and one social theme for the issue “health and safety”:

- 4) occupation injury and deaths: single issue “fatal injuries by country” (Norway)

The countries involved as suppliers and sub-suppliers were selected individually or contemporary and showed in risk maps. We found very high risk of fatal injuries in the wool product sector for the social category “health and safety”.

Also in the bio refinery case, the highest risk of social impacts at country level (Norway) and sector (forestry; chemical, rubber and plastics product) were connected to the health and safety category.

These results lead to questions why the risk of occupational injuries was so severe in Norway for the health and safety category, if Norway had better reporting system and availability of statistical data and if there were economic incentives for reporting injuries.

In conclusions, we can point out that there is interest in assessing social impacts of products, but at the same time, stakeholders are not prepared to answer to social questionnaire and sceptical to qualitative data. Hence, generic data were used as representative of specific case study. Social Hotspot database was a good starting point for highlighting the social hotspots along the supply chain, but it is necessary to perform deeper analysis for finding out the realibility of data. In addition, several assumptions were necessary. In all our cases, the products were at small-scale production (laboratory for the nano-cellulose, demo plant for the bio-chemicals, boutique for the textile), but the company are interested to scale it up, requiring therefore to make lots of assumptions. Not all sectors are yet represented in the database, so we assumed the corresponding ones (e.g. chemical, rubber and plastics for biochemical products at bio-refinery and for synthetic materials in the textile case study).

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Projects:

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2. NNB: «New Norwegian Biorefinery» (biochemicals case study)
3. NORCEL: «The NORwegian nanoCELLulose Technology Platform» (nano-cellulose case study)

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Session 3 bis

Questioning UNEP-SETAC and social Hotspots Database (SHDB)

Social sustainability in trade and development policy

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1. Introduction

Sustainability is a guiding principle and objective for policy development in the European Commission (EC) (EC 2001a). The EU Sustainable Development Strategy (SDS) requires an impact assessment of all major policy proposals vis-à-vis sustainability objectives (EC 2009). Sustainability is based on four fundamental pillars: environmental, economic, social and institutional sustainability. Socio-economic aspects are fundamental both as drivers of potential impacts as well as possible elements of the system that are subject to impacts along product supply chains. These aspects are of particular relevance to the sustainability dimensions of trade and development policies.

The founding Treaty of the European Union specifically includes the objective of ‘fostering sustainable economic, social and environmental development of developing countries, with the primary goal of eradicating poverty’ (Article 21(3)). Following the Lisbon Treaty (Article 21(3) TEU and Articles 205 and 208(1) TFEU), the EU’s external policies must respect the ‘principles of democracy, the rule of law, the universality and indivisibility of human rights and fundamental freedoms, respect for human dignity, the principles of equality and solidarity, and respect for the principles of the United Nations Charter and international law’ (EC 2008).

With respect to trade policy, since the early 1990’s all EU trade agreements have been required to incorporate a clause defining ‘human rights’ as a basic element. This clause encompasses the core labour standards as defined in the International Labour Organisation (ILO) Conventions. More specifically, the Council conclusions of October 1999 outline the EU’s position on trade and labour in social development (EC, 2001b). Here, the Council agreed that the EU should strongly support the protection and respect for core labour standards; provide support for the work of the ILO as well as its co-operation with the World Trade Organisation (WTO); and oppose any sanctions-based approaches (EC 2001b). The Commission’s subsequent *Communication on ‘Corporate Social Responsibility: A Business Contribution to Sustainable Development’* encourages the adoption of ‘codes of conduct, management standards, instruments

for measuring performance, labels on products, and standards for Socially Responsible Investment (SRI), in order to direct investors towards enterprises in light of their corporate social responsibility results' (EC 2002).

In this context, life cycle thinking and life cycle-based methodologies are considered, due to their systemic nature, to contribute the core feature of robust sustainability science (Sala et al 2013 a and b). Life Cycle Assessment, Life Cycle Costing and Social Life Cycle Assessment (sLCA) may, hence, play a central role in helping to define better policy options towards sustainable development.

In order to assess the efficacy of sLCA applications in policy contexts, there is the need to evaluate its added value based on case studies at different scales (i.e. at micro (product) as well as meso (regional) and macro (country/ global) scales). To date, application at meso and macro scales are very limited (see. e.g. Rugani et al 2012 on Luxembourg and EU 27; Ekvall, 2011), whereas examples of application of sLCA at product level are more common and already cover a number of key products and services (some of them even with complex international supply chains) such as biofuels (e.g. Macombe et al 2013), bananas (Feschet et al 2013), laptop computers (e.g. Ekener-Petersen and Finnveden, 2013), and tourism (Arcese et al 2012).

The present study focuses on application of sLCA at the macro scale, with the aim of assessing its potential relevance and use in trade and development policy contexts.

A case study has been carried out for EU 27 Member States, considering the origin, magnitude and distribution of social risk associated with traded commodities. The analysis employs two approaches in order to assess the added value of life cycle thinking and tools in this context. The first is a non-life cycle based "country of origin" approach, and the second is a life cycle based cradle-to-country of consumption approach.

2. Methodology

The primary objective of this study is to evaluate the social risks attributable to imports of traded commodities into EU-27 Member States in 2010 from both intra and extra-territorial trading partners. This is achieved by combining Eurostat ComEx import data at the HS06 level (Eurostat, 2013), mapped to GTAP sector codes, with the country/sector-specific social risk indicator data currently available in the Social Hotspots Database (SHDB) (Benoit et al 2010).

The SHDB is a repository of social indicator data relevant to five overarching thematic areas: Labour Rights and Decent Work (reporting indicators of: Child labour; Forced labour; Excessive working time; Wage assessment; Poverty; Migrant labour; Freedom of Association, Right to Strike, and Collective Bargaining Rights); Health and Safety (indicators on Injuries and fatalities; Toxics and hazards); Human Rights (Indicators of Indigenous rights; Gender equity; High conflicts); Governance (indicators of Legal

system and corruption); and Community Infrastructure (indicators of Hospital beds; drinking water; sanitation). Data used to populate the SHDB are drawn from a broad range of reputable, publically available sources such as the statistical agencies of the World Bank, the World Health Organization, and the International Labour Organization. Privately held audit databases are also used. In total, more than 200 data sources are consulted. Where data sources do not contain comprehensive data across countries for specific issues, multiple data sources are used and the findings triangulated. The data currently available for each indicator cover 113 specific countries and 57 sectors (for a total of 6,441 country/sector-specific combinations) as defined in the Global Trade Analysis Project (GTAP) input-output economic general equilibrium model (GTAP 2013).

The SHDB is intended for assessing social risk and identifying hotspots in product supply chains. This is accomplished by using the Life Cycle Attribute Assessment approach (Norris 2006) to aggregate social risks (attributes) that occur at different points along product supply chains based on a common activity variable. In this case, the activity variable employed is worker hours. The SHDB uses a Worker Hours Model that is derived by dividing total wages paid out by country and sector per dollar of output based on the GTAP input - output model, and country/sector-specific wage estimates to characterize worker hours per country, sector, and dollar of output. By multiplying the level of social risk in country-specific sectors by the worker hours per dollar of output in each sector, the SHDB, hence, allows for quantifying (in an additive manner) and assessing the distribution of potential social risks along product supply chains. Risks are quantified in units of “medium risk hours,” which is the number of worker hours along the supply chain that are characterized by specific or aggregate social risk. Here, risks levels are weighted for each indicator in order to express instances of low risk, medium risk, high risk and very high risk in terms of “medium risk hour-equivalent units” (mrh eq).

In order to map Eurostat HS06 trade data (7395 unique classifications) from ComEx to the GTAP sectors employed by the SHDB, the study used a concordance table from the World Bank (2013). Since Eurostat trade data does not include services, this reduced the number of GTAP sectors considered in the analysis from 54 to 43. Where full, six-digit HS06 data were not available for specific trade flows for confidentiality or other reasons, these were excluded from the analysis. This accounted for 1,116 of the 7 395 unique HS06 codes reported by Eurostat for imports to EU-27 Member States in 2010. Such exclusions generally represented minor fractions of overall trade flows. In some cases, however, exclusions were non-trivial for certain trading partners. Overall, however, only 2.5% of import flows by value were excluded from the analysis on this basis.

Data for a total of 78 extra-territorial trading partners, along with the (at the time of the study) 27 Member States of the EU-27, were considered. Although EU-27 Member States actually traded with a total of 202 extra-territorial trading partners in 2010, this nonetheless effectively encompassed 88.4% of imports by value from extra-territorial trading partners, 95.5% of imports by value from intra-territorial trading partners, and

92.8% of overall imports by value into EU-27 Member States in 2010. GTAP-mapped Eurostat ComEx trade data and SHDB social risk indicator data were then combined in two ways: a country of origin (A) approach and a life cycle based (B) one.

First, in the country of origin approach (A), we undertook to assess the comparative social risks attributable to products imported into the EU-27 from extra-territorial trading partners compared to similar products produced and traded within the EU-27, taking into account the social risk scores for country- and sector-of-origin only (i.e. not using a life cycle approach). Here, we used Excel spreadsheets to multiply the social risk scores of imports for each country/sector combination by the % by value that imports from the country/sector combination contributed to total (intra- or extra-territorial) import values for that sector. This resulted in a value-weighted average indicator score per euro of imports for each sector and for each of the 117 sub-indicators, which were subsequently also multiplied by total trade value by sector to obtain overall risk scores for each sub-indicator.

We applied the same set of sub-indicators and the same weighting scheme used in the life cycle-based social risk assessment method in order to re-express the sub-indicator results per indicator (characterization), social theme (damage assessment) and as a single score. This allowed us to rank sectors in terms of apparent social risk per euro spent on imports from a sector as well as based on the total value of sectorial imports for both intra- and extra-territorial imports. We also computed “externalization ratios,” which are intended to convey the ratio of risk associated with the production of traded products outside of territorial boundaries to that which occurs within the EU-27, per euro spent on traded goods in each sector.

Second, applying a life cycle –based (B) approach, we performed a life cycle-based evaluation of the social risk profile of EU-27 imports in 2010 using the version of the SHDB currently available in the SimaPro 8.0 software package. Here, we entered all GTAP-mapped trade data for imports by sector from intra- and extra-territorial trading partners into a SimaPro model and used the Social Life Cycle Impact Assessment Method Version 01.1 to assess the magnitude and distribution of social risks attributable to EU-27 trade by sector and in aggregate. Characterization results by social theme, damage assessment results by thematic area, and aggregated, single scores for life cycle social risks were generated. As before, we computed externalization ratios per euro spent on trade in each sector.

In order to directly compare the country-of-origin versus life cycle-based social risk assessments, we transformed both into % contributions to total risk for each measure. We subsequently compared results between the country-of-origin and life cycle-based assessments in order to determine if these two approaches provide different ‘signals’, and to evaluate the relevance of a life cycle approach to understanding and managing social risk. Further methodological details and results are reported in Pelletier et al. (2013).

Results

Applying the two approaches (as described in methodology A and B), the following key observations emerged:

- There is a disproportionately large contribution to overall social risk attributable to the Injuries and Fatalities indicator in both analyses (A and B). This is strongly influenced by the high weighting for risk of fatalities relative to the weightings for the other social risks considered.
- The Injuries and Fatalities risk indicator is proportionately more important relative to the other risk indicators in the country-of-origin analysis (90% compared to 72% in the life cycle-based analysis).
- There is a much larger degree of social risk attributable to extra-territorial imports compared to intra-territorial imports, again for both analyses (almost 100% for the country-of-origin analysis and 83% for the life cycle-based analysis).
- Considering individual social themes, contributions from intra-territorial trading partners are negligible across indicators in the country-of-origin analysis for overall trade, but range from 9% for risk of Child Labour to 20% for risk of Injuries and Fatalities in the life cycle-based analysis.
- Turning to single scores results at the sectorial level for total EU-27 imports in 2010, the results of the country-of-origin versus life cycle-based evaluations of social risks are even more divergent. Both the distribution of risks between sectors and the relative importance of extra- versus intra-territorial imports vary widely.
- Considering single score results per euro spent on trade in each sector also presents highly divergent results between the country-of-origin and life cycle-based evaluations, as the influence of magnitude of trade flow is not a factor here.

3. Discussion and conclusion

Our analysis underscores the importance of a life cycle-based approach to understanding and managing social risk in support of policies for socially sustainable development. Both approaches (A and B) that we evaluated provide the same high-level insights that (1) the majority of social risks associated with imports to EU-27 countries are attributable to extra-territorial rather than intra-territorial imports, and (2) the risks of Injuries and Fatalities make the largest proportionate contribution to an overall, single-score measure of risk. However, these two approaches provide otherwise dissimilar “signals” as to the magnitude and distribution of social risk. The approach (A) would invariably prioritize interventions targeting only those direct trading partners known to have high levels of social risk in the sectors providing exports to EU-27 Member States. In contrast, the approach (B) provides insight as to the distribution of risk along supply chains, which may be low in the sector of a given country exporting products to Europe, but high overall for those products due to the social risks associated with the activities that support production in that sector.

Although we observe that the majority of social risk associated with total trade flows is attributable to extra-territorial imports, this is nonetheless also relevant for intra-territorial trade. If considering only country/sector-of-origin social risk, intra-territorial imports may appear to have low associated social risk. Consideration of the distribution of social risk along upstream supply chains, however, may provide a very different picture if inputs to production within specific sectors in EU-27 Member States come from extra-territorial trading partners with higher social risk profiles. Hence, targeted policy initiatives to mitigate social risk in the interest of leveraging improved social sustainability based on either of these approaches would prioritize different countries and sectors.

The case study also highlighted the need for better considering certain methodological issues: i) as the methodology implies a weighting scheme, this weighting should be carefully considered and possibly subject to sensitivity analysis; ii) even if the source of data are considered trustworthy, reliability of data and comprehensiveness could be questioned, in particular for those countries under critical political conditions ; iii) the scale of the assessment (country) is the best trade-off for ensuring data availability; nonetheless, sub-country (regional) differences may imply huge variability for the results; iv) the use of human labour as an indicator is questioned in the literature and could be also subject to sensitivity analysis adopting other reference indicators (e.g. Iribarren and Vázquez-Rowe, 2013)

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Is there a scientific justification for the current use of child labour and working hours in social LCA?

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1. Context and scope

The main idea behind social life cycle assessment (SLCA) is to assess social impacts of products and services in a similar manner as environmental impacts are assessed in environmental LCA (ELCA). In 2009, guidelines for SLCA were published (Benoît et al. 2009), hereafter referred to as the UNEP/SETAC guidelines. A number of LCA case studies have since then been conducted, some that claim to follow the UNEP/SETAC guidelines, and some that do not. The methodological variations that can be found in these case studies implicate the need for further methodological discussions. This need was also identified in the UNEP/SETAC guidelines, in which elaboration of social indicators was one specifically identified area for future research.

One important feature of ELCA is its foundation in the natural sciences. Descriptions of environmental impacts such as global warming and acidification can be found in basic environmental science textbooks. Environmental indicators such as the life cycle global warming potential of a product thus rest on a natural science foundation. It has been recommended that sustainability indicators in general (Meadows 1998) and social indicators in particular (Noll 2002) should rest on a scientific basis. Suggested subcategories in the UNEP/SETAC guidelines, however, are adopted from political standards and documents published by international organizations. This implies an agreement of the UNEP/SETAC guidelines with such political documents. The extent to which these politically-based subcategories are in agreement with how they are described in the scientific literature calls for an investigation.

In a previous article, some of us pointed out that some subcategories recommended in the UNEP/SETAC guidelines could be interpreted differently depending on cultural background and on political, ethical and ideological views (Baumann et al. 2013). In this article, we continue the analysis by examining the scientific findings in the wide research literature related to two subcategories suggested in the UNEP/SETAC guidelines: *working hours* and *child labour*. The chosen subcategories are among the most frequently utilized in SLCA case studies. Only Clift et al. (2013) and Jørgensen et al. (2010) have previously evaluated the use of child labour as social topic in an SLCA context.

2. Method

A multi-disciplinary review of the research literature was carried out in order to obtain an understanding of the current knowledge pertaining to the two topics selected for examination, working hours and child labour. First, we investigated the ways in which the subcategories were handled and discussed in conducted SLCA studies and in the UNEP/SETAC guidelines. Then, we conducted a review of the non-SLCA scientific literature. This scientific literature was obtained through searches on “working hours” and “child labour OR child labor” in the scientific database Sciencedirect (<http://www.sciencedirect.com/>). We considered the first 1 000 hits for each topic. From these 1 000 publications, studies that were considered to be of high relevance based on the content of their titles were selected. The articles were then subject to further relevance scrutiny by consideration of their abstracts and main texts. The studies identified were mainly from the fields of social science and economics, including labour economics, development economics, development studies, ergonomics, and anthropology. In addition to these, two studies of high relevance for the topic child labour were included. Content analysis in a framework of positive and negative associations was conducted on both the studied SLCA case studies and the wider research literature, in a similar manner as was done by Boholm and Arvidsson (2014). Note that a topic can be regarded as having positive social value by either causing benefits or preventing harm. Similarly, a topic can be regarded as having negative social value by either causing harm or preventing benefits. Note also that the classification of something as being a harm or benefit was not done by us, but deduced from the writing in the reviewed literature. The contrast between the SLCA case studies and the wider research literature provides the basis for our discussion.

3. Working hour results

Working hours is used in several SLCA case studies (Bouزيد and Padilla 2014, Ciroth and Franze 2011, Ekener-Petersen and Finnveden 2013, Franze and Ciroth 2011, Hunkeler 2006, Manik et al. 2013, Martínez-Blanco et al. 2014). Notably, it is used in two different ways. Some calculate number of working hours required per functional unit. Other studies do not quantify the number of working hours required per functional unit, but instead report the working hours per person and week for workers along the product life cycle. In these studies, working hours are often related to a threshold level, which is often 48 hours per person and week, above which the working hours are considered socially adverse. Employment, or rather its opposite unemployment, is an issue much interlinked with working hours. *Local employment* is a subcategory suggested in the UNEP/SETAC guidelines for the stakeholder category local community, and is also used in a number of SLCA case studies (Ciroth and Franze 2011, Ekener-Petersen and Finnveden 2013, Franze and Ciroth 2011, Hosseinijou et al. 2014, Weldegiorgis and Franks 2014). In those cases, an increase of local employment is considered beneficial.

In the wider research literature, the relationship between working hours, happiness and health is investigated in several studies. These studies typically report that the relationship between working hours on one hand and happiness and health on the other follow an inversed U shape relationship. When increased from a low level, additional working hours typically increase happiness and health, possibly due to higher status and more social contacts. Additional working hours can, however, affect both happiness and health negatively. The extremes of high working hours, such as workaholism, are clearly deteriorating for health and happiness. It is also clear that individual preferences have a large influence on whether high or low working hours cause increased or reduced happiness and health. It is also noted in many studies that when the work takes place (e.g. day work or night work) is important. A number of authors discuss flexible working hours, typically concluding that variable working hours were associated with poor health and well-being. The relationship between working hours per person and unemployment is also discussed in several studies, with differing results. Some suggest that working hours reduction increase unemployment, whereas other suggest the opposite.

The results from the review of working hours in the wider research literature are summarized in Table 1. The summary implicates a delicate balance between working too much, causing stress and other health problems, and working too little, with the extreme of unemployment and subsequent losses of salary and well-being as result. This balance is individual, and one crucial aspect seems to be the degree of freedom one has to distribute the working hours over time. There also seems to be a complex correlation between working hours and unemployment. This summary points to a difficulty with current measurement of working hours owing to the equivocal positions on this topic.

4. Child labour results

Child labour is the employment of people under a certain age. In the UNEP/SETAC guidelines, it is clear that much child labour is considered to be socially adverse. Child labour is also assessed in several SLCA case studies (Bouزيد and Padilla 2014, Ciroth and Franze 2011, Ekener-Petersen and Finnveden 2013, Franze and Ciroth 2011, Hosseinijou et al. 2014, Manik et al. 2013, Martínez-Blanco et al. 2014).

There are several records of children suffering from child labour in the non-SLCA scientific literature. Examples include children with lower body mass index (BMI) and delayed genital development in India, children working with small-scale gold mining with symptoms of mercury intoxication, children exposed to various health hazards and abuse in Jordan industry, abused children in factories in Turkey, and several health- and comfort-related problems of child labourers in Venezuela. But there are also other studies in which social benefits of child labour are emphasized while distinguishing between different forms of child labour. Beneficial forms include labour that helps building the child's character in terms of, for example, punctuality

and discipline, such as newspaper delivery and baby-sitting. It is further reported that poverty causes child labour, prompting the need for any extra income. In such studies, it is argued that any reduction or prohibition of child labour will lead to socially more undesirable outcomes unless some mitigation for loss of income is offered.

Table 1 summarizes the results from the review of the wider research literature on child labour. This summary points to problems of using child labour as a social topic. A certain amount of child labour, corresponding maybe to a part-time or summer job, seems to be beneficial for building of character and learning discipline and punctuality. Little or no child labour may result in poverty in regions where neither parents nor society have the financial possibility to provide for the child. Note that this adverse social impact does not exist in high income countries. With a higher amount of child labour, however, stress and health problems are likely to occur, although this may depend on the type of work and working conditions. This distinction of child labour into the worst forms and other, not so problematic or even beneficial forms, is not done in the SLCA literature. In addition, problems of loss of income from reduced child labour are not included in the SLCA literature, although they may be crucial for the child labourer and his or her family.

Table 1: Summarized results from the review of the wider research literature on working hours and child labour.

Social topic	Benefits caused	Benefits prevented	Harm caused	Harm prevented
Increased amount of working hours	Happiness, status, health	Happiness, health, well-being	Workaholism, dissatisfaction	Dissatisfaction
Reduced amount of working hours	Health, increased wages	Health, well-being, money, development of skills, social interactions	Dissatisfaction, unemployment	Workaholism, dissatisfaction, unemployment
Increased amount of child labour	Building character, punctuality, discipline, income	Health	Abuse, injuries, many types of health problems, dropping out of school	Poverty
Reduced amount of child labour	Health	Building character, punctuality, discipline, income, welfare of households, sending children to school	Increased child labour, poverty, vulnerability on the labour market	Abuse, many types of health problems

5. Recommendations

Whereas the SLCA literature suggests that working hours and child labour cause social harms, the wider research literature reports a more complex picture of social benefits and harms. Table 1 shows how these two topics contribute to both socially benefits and harms, both for individuals and for society as a whole. Sometimes, studies suggest that the same topic both causes and prevents the same benefit or harm. This ambiguity, or perhaps even pluralistic character, of the studied topics leads us to question the usefulness of these topics in SLCA studies. We recommend future developments of SLCA methodology be based also on insights from the social sciences, in combination with systematization of empirically experiences (Baumann et al. 2013).

Given that our literature review was limited to 1000 publications for each topic, it is likely that a more comprehensive literature review would have produced an even richer understanding and more diversified positions than what was summarized in Table 1. We find it likely that the fields of social science and economics may contain additional valuable insights for topic and indicator development in SLCA. In addition, related fields also pursuing methods for social assessment exist, for example, social impact assessment, social certification (SA8000 and ISO26000), and the recently developed field of happiness studies, devoted to studies of the subjective well-being of humans. This warrants further study and comparison of approaches.

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From potential hotspots identification to social issues prioritization

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1. Context and scope

Social LCA is a tool developed in order “to promote improvement of social conditions throughout the life cycle of a product” (UNEP-SETAC, 2009, p. 22) by means of improving companies’ behaviours, as they pertain to their activities and decisions, to ultimately achieve Sustainable Consumption Patterns (SPC) (Parent et al., 2012). Especially for multinational corporations, decisions concerning strategic activities such as supply chain management are made against impacts that must be measured and prioritized in order to be appropriately managed.

One way social LCA can provide information on manageable and targeted social issues is by a social hotspots assessment. Taking stock of such an assessment, LCA sponsors are often confronted with the complexity of targeting social issues which, in some cases, run deeper than what one company can do. On one hand, questions such as: “How can our company prioritize the many hotspots in our value chain?” are emerging more and more from decision makers. On the other hand, the scientific community clustered around social LCA has also outlined the importance of weighting social impacts subcategories, either for calculation purposes (Benoît Norris, 2012), for ethical reasons (Ekener Petersen, 2014) or in order to advance social LCA research, specifically as it relates to its intended effects (Jørgensen et al., 2009). If social LCA is, indeed, a tool that can improve human well being throughout a product’s life cycle, proposing an effective operationalization of social LCA results through a process of prioritizing social impacts begs an investigation.

Although social LCA is a technique that is still in its infancy compared to environmental LCA, a number of studies have nevertheless been produced since the UNEP-SETAC Guidelines (2009). One of these case studies was conducted for the Société des Alcools du Québec (SAQ)¹ as an Industrial partner of the CIRAIG’s International Life

¹ The SAQ is the state-run organization that manages the alcohol trade in the province of Québec, Canada. The International Life Cycle Chair wishes to thank the SAQ for allowing the disclosure of the results of this research project.

Cycle Chair (ILCC)². The ILCC produced for SAQ an LCA³ of wine for 11 geographically referenced scenarios⁴, in order to ultimately create a transparent decision making tool for consumers. For the social dimension of the LCA, the assessment was conducted by the social research team of the Chair. One phase of the life cycle (production) and one stakeholder category (workers) were assessed. A total of thirteen⁵ significant social issues were found to be prevalent, occurring unevenly across the assessment's scenarios. In all countries, migrant workers were especially highlighted as the sub-stakeholder category most at risk of experiencing these social issues. Faced with so many hotspots, the SAQ sponsored a second study in order to facilitate a social impacts subcategories prioritization framework, which could guide the SAQ and its suppliers in sequentially attaining a better overall social performance. This framework is the basis of this ILCC's presentation.

2. Main text

First, a literature review was conducted in order to create a normative basis for the prioritization framework. Five main literature categories were investigated: 1) international conventions, 2) corporate social responsibility (CSR) initiatives and standards pertaining to social issues, 3) internationally applicable private standards guidelines focusing on the appropriate social issues and applicable to the agro/wine sector, 4) scientific and grey literature exploring correlation or causal links between social issues and 5) literature pertaining to migrant workers.

Literature review main findings

There are three main findings from the literature review, across the board for the 5 review subjects. The first is that the rights covered in the International conventions, principles and declarations are indivisible, interdependent and mutually reinforcing. The second is that the Universal Declaration of Human Rights (United Nations, 1948) and the ILO'S Declaration relative to fundamental principles and rights (ILO, 1998) are the two main instruments on which most of the public or private initiatives, programs or standards are built upon. Thirdly, freedom of association and the recognition of the right to collective bargaining are found to be enabling rights, meaning rights that allow the promotion and realization of other rights leading to decent working

2 The International Life Cycle Chair is a research unit of Polytechnique Montréal and ESG UQAM.

3 The environmental and social life cycle assessment was conducted in 2012-13 by the International Life cycle Chair team of analysts and students.

4 These are : Argentina, Australia, Chile, France, Italy, New Zealand, Portugal, Quebec, Spain, South Africa and the United States.

5 The 13 social issues found to be prevalent are: violation of migrant workers' fundamental rights, child labor, freedom of association and the right to collective bargaining, forced labor, inequalities in working conditions, non-decent wages, non-payment of certain worked hours, failure to deliver legally binding social security benefits, excessive working hours, non-payment of overtime bonus, failure to use practices that minimize workers' health & safety risks, degrading practices, non-formalization of the rights and obligations of the worker and the employer through a written contract of employment and job insecurity, non-adoption of practices to ensure a decent living environment (when workers were found to be living on work premises).

conditions (ILO, 2013). And finally, the Decent Work Agenda (ILO, 1999) is recognized as a normative framework that identifies work that must be abolished as well as the most fundamental rights, without which it cannot be possible to call work “decent”.

Within the CSR initiatives literature review, only one presented a principle that could constitute a lead in hierarchizing social issue. The Ethical Trading Initiative (ETI, 1998) recommends to pay particular attention to the most vulnerable workers and to the most abusive labor practices workers, including workers employed by agencies, temporary workers, and migrant workers. Within the migrant workers and correlation/causal links literature review, what clearly emerges is that the migrant workers are the most vulnerable worker sub-category within the larger « Workers » UNEP-SETAC stakeholder category. Their status can generally be considered a precursor for poor working conditions. The migrant worker's inability to join a labor association or participate in collective bargaining specifically leads to rights violations. Freedom of association and collective bargaining is also a precursor to the presence or absence of child labor. Other major impact sub-categories are, in essence, included in the four dimensions of the Decent Work Agenda. This instrument was thus used as a tool to illustrate links between the UNEP-SETAC social impact sub-categories, social issues and one or more of the 4 dimensions of Decent Work, as illustrated in Figure 1.

Prioritization framework design and application

Two different scales were designed to help prioritize social issues. The first draws on the literature review's findings and provides a social issues severity scale. The second is a country level socio-economic evaluation, based on Decent Work indicators. These two scales, as well as the final geolocalized social issues prioritization, will be explained in the remainder of this presentation.

Scale 1: Social issues severity scale

This scale was built on the main findings from the literature review, which were:

- Fundamental principles and workers rights, as enacted in the ILO Declaration, take precedence over other rights and issues
- Precursor rights are particularly salient. Among them, freedom of association and the recognition of the right to collective bargaining are clearly highlighted.
- Migrant workers are the most vulnerable sub-category of the « Workers » stakeholder category in the wine growing industry and therefore, the most likely to be victims of non-decent working conditions or human dignity violations.

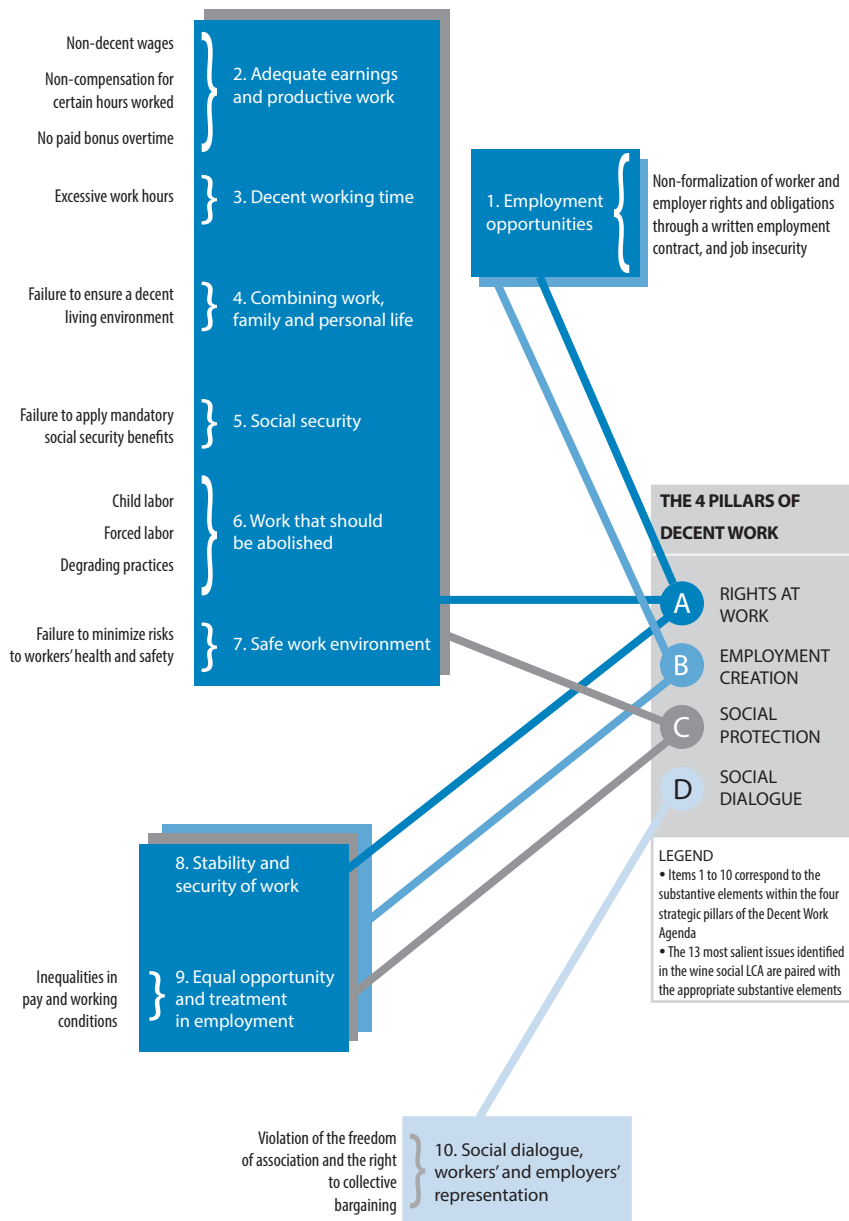


Figure 1: Link between the Decent Work Agenda and social issues identified in the wine LCA

Furthermore, a greater importance was assigned to issues directly related to income and health & safety. The principles put forth as justification for their inclusion are the reduction of poverty through decent pay, an important ILO goal, and the importance of the physical integrity of individuals, which constitutes a fundamental condition for a decent life. Using these benchmarks, a three-level scale was established. The S1 level corresponds to issues directly related to fundamental principles and workers rights (threshold of maximum severity). The S2 level corresponds to issues directly related to the specific challenges of migrant workers in terms of their employment contracts, as well as other issues related to wages and health & safety (less severe than S1). Finally, the S3 level was granted to the remaining issues, which deal mostly with working conditions (least severe level). All levels are described in Table 1.

Table 1: Social issues prioritization

S1	Issues directly related to the ILO's fundamental rights and principles declaration and Decent Work Agenda Child labor, freedom of association, forced labor, discrimination and practices that negatively affect human dignity
S2	Issues relating to wages, health and the formalization of the employment relationship by the contract Salaries and benefits, health & safety, labor relations and job insecurity, workers' housing (when provided by the employer)
S3	Other issues Failure to offer legally imposed social security benefits, excessive working hours, failure to provide overtime pay

Scale 2: Country level socio-economic evaluation

The second scale draws on the ILO's Decent Work Agenda's indicators, which offer somewhat comparable information via quantitative and qualitative data (ILO, 2012). The indicators, that took a decade to be designed and implemented, were first published in 2012. They comprise data pertaining to national legal frameworks and cover the 4 dimensions of Decent Work within 11 indicator categories⁶: 1) Economic and social context for decent work, 2) Employment opportunities, 3) Adequate earnings and productive work, 4) Decent working time 5) Combining work, family and personal life, 6) Work that should be abolished 7) Stability and security of work, 8) Equal opportunity and treatment in employment, 9) Safe work environment, 10) Social security and 11) Social dialogue, workers' and employers' representation.

⁶ In addition, the indicators are divided into four categories: 1) Key indicators: representing priority indicators; 2) additional indicators: can be used for relevance and availability; 3) Background information: for better understanding of other indicators in their socio-economic context; and 4) future indicators: not yet used (under development by the Office of the ILO) (ILO, 2012). Only statistical indicators in the leading indicators are considered.

Eighteen indicators from the Decent Work framework⁷ were included as a basis for the country scale socio-economic evaluation, as an integral analysis of all 92 indicators was not only inappropriate for the scope of the research project, but also was not possible within the allotted time frame. Congruence with confirmed social issues, accessibility and comparability, as well as expert judgment were used to prioritize which indicators were to be selected.

Based on the country portraits that were thus created from the analysis of the 11 indicators, a 3 levels scale was constructed, comprised of R1 (first rank), R2 (second rank) and R3 (third rank). The R1 scale corresponds to countries scoring low on the Decent Work inspired scale, whereas R3 countries presented the highest characteristics for presence of Decent Work.

Using this scale, South Africa (in comparison to the 10 other scenarios) was found to present the least amount of conditions leading to Decent Work. Close seconds are Argentina and Chile (R2). Finally, the United States, Italy, Spain and Portugal were classified as R3. It is important to note that the remaining countries not part of the ranking (Canada, France, New Zealand and Australia) may have Decent Work challenges, but these were not apparent from the chosen indicators. It is to be noted also that the indicators constitute a national and aggregated portrait that cannot be expected to paint a precise portrait of the agricultural sector or of wine growing. Therefore, the ranking merely acts as a backdrop for social issues found to be prevalent from the social LCA results. It can also be used by the SAQ as a way to prioritize programs or dialogue with the country or countries ranking highest in this scale.

Table 2: Prioritization based on 11 Decent Work Agenda indicators socio-economic portrait

R1	Most socially precarious: South Africa
R2	Very socially precarious: Chile
R3	Socially precarious: U.S., Italy, Spain and Portugal

Social issues and country hierarchy

Finally, the proposed ranking is based on the two previously explained scales (social issues severity and countries' social performance) as well as on the highest number of social issues identified in the wine social LCA. At the SAQ's request, it was decided to produce a country ranking as a deliverable, as it was considered a more manageable

7 It should be noted that the Human Development Index (HDI) and the number of temporary migrants are not native to this framework and have been added as deemed appropriate by the research team.

way of prioritizing actions and plans on a global scale with geographically distributed wine merchants. The final ranking is based on this three-pronged evaluation, presented in Table 3.

Table 3: Three pronged analysis of social issues based on country level prevalence

Rank	Social issues severity scale (S scale)	Socio-economic evaluation scale (R scale)	Wine Social LCA
P1	South Africa	South Africa	South Africa
	Chile		Chile
P2	Argentina	Argentina	Argentina
	Spain	Chile	Spain
	Italy		Italy
			New Zealand
P3	France	U.S.	U.S.
	New Zealand	Italy	Québec
	Australia	Spain	Australia
	U.S.	Portugal	
	Québec		

Thus, a final 3 levels scale was developed, a result of complementary research and much discussion within the research team. The first row of the ranking, P1, includes Chile and South Africa, as these countries have the largest number of social issues with the highest severity levels (S1 and S2). Both countries have over four issues identified in each of these levels. The second row, P2, includes Argentina, Spain and Italy, countries that host two to three S1 issues and two to three S2 issues. The third row (or P3) is shared by France, Australia, the United States, Québec and New Zealand, as they are home to one or two S1 or S2 issues. In this category, France and New Zealand stand still as lying closer to the second than the others because they clearly have a higher number of issues than their peers.

Table 4: Final geolocalized social issues prioritization

P1	Largest number of S1 and S2 social issues: South Africa and Chile
P2	Argentina, Spain, Italy
P3	France, Australia, US, Québec, New Zealand

Implementation perspectives and recommendations

Following the proposed hierarchy of social impacts to be considered, the ILC Chair proposed general principles as a guide for the initial implementation of the prioritization process. These principles cover issues such as the proper use of private standards as ways to tackle hotspots within the 13 scenarios, recommendations as to human rights vigilance according to scenarios, data to be collected to bridge information and assessment gaps, and general governing principles for the eco-socio labelling scheme.

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Identification des points chauds potentiels : SHDB versus collecte de bureau

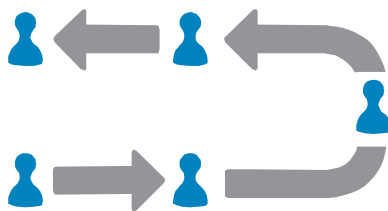
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Depuis sa conception même, la Social Hotspots Database (SHDB) a été considérée comme un outil permettant de réduire le temps de collecte et d'analyse des données en analyse sociale du cycle de vie (AsCV), entre autres en rendant possible l'identification rapide des points chauds potentiels au sein de la chaîne d'approvisionnement d'un produit. Dans bien des études, la SHDB a été utilisée pour donner le premier coup de sonde dans un système de produit, identifiant des points chauds potentiels pouvant être par après approfondis via d'autres méthodes de collecte et d'analyse.

Est-ce que la SHDB est toujours le meilleur instrument pour jouer ce rôle de sentinelle dans l'identification des points chauds potentiels dans un système de produit ? Comment se comparent les résultats générés par la SHDB à ceux issus d'une collecte de bureau exhaustive visant à identifier également les points chauds potentiels dans un système de produit ?

En s'appuyant sur deux récentes AsCV produites par le CIRAIG, où une gamme de secteurs/pays a été d'abord analysée via une collecte de bureau exhaustive et ensuite via la SHDB, cette présentation fera une comparaison entre les résultats générés par ces deux méthodes de collecte et d'analyse. Elle mettra en lumière le niveau de chevauchement des résultats entre les deux méthodes, leurs divergences, ainsi que les raisons qui peuvent les expliquer. Sur la base de cette comparaison, la présentation proposera également une liste de critères permettant d'identifier dans quels cas il est plus probable de déceler des divergences importantes entre ces deux méthodes de collecte et d'analyse.



Session 4

Pathways to assess social effects

Including resource security of supply in LCA: a proposal

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1. Context and scope

The security of supply of mineral raw materials has become a high-priority theme in the political agenda of many countries, especially those highly dependent on imports. At EU level, resource security is claimed as a policy objective both in the Raw Materials Initiative (EC - European Commission 2008) and within the resource efficiency policy (EC - European Commission 2011a; EC - European Commission 2011b). "Criticality" has also emerged as a research subject and different methodologies for assessing critical raw materials have been developed. Most of them are based on supply risk and vulnerability of a system to a potential supply disruption (Erdmann and Graedel 2011). Security of supply is also one of the conditions for ensuring a sustainable supply of raw materials. It is debated if environmental Life Cycle Assessment (LCA) (ISO 14044 2006) should take into account resource security, as well as other socio-economic issues related to resources or if these aspects should be included in a social LCA (Klinglmair et al. 2013; Mancini et al. 2013; Mancini et al., in press).

Nevertheless, resource security is a recurrent issue over history, mainly determined by the uneven geographical distribution of mineral reserves around the globe and the consequent import dependency in resource-poor countries (Buijs et al. 2012). This concern has recently regained importance. Global population growth, new consumption habits, technological change and economic development of some countries have enlarged the demand for raw materials both in terms of amount and variety of materials used. Some metals are increasingly relevant for emerging technologies, including those that are supposed to contribute to more sustainable societies, e.g. low carbon energy supply and transportation technologies.

Supply of raw materials can be threatened by different factors: geological, technological, geo-political, economic, environmental and social. In the criticality assessments the aspects that are commonly included are related to the raw materials markets and economy (e.g. market concentration, consumption and demand); technology (e.g. recycling potential substitutability, companion production and by-products) and geo-political (governance and political stability of producing countries). Biophysical availability of raw materials is also included in some

assessments (Morley and Eatherley 2008; Erdmann et al. 2011; Graedel et al. 2012) while in others this aspect is not addressed due to the short time frame of the study, e.g. in the assessment of critical raw materials (CRM) for the European economy by the European Commission (EC - European Commission 2010; EC - European Commission 2014). In this methodology the identification of CRMs is based on two main variables: economic importance and supply risk.

Resource availability for present and future generations is a central issue in the sustainability science. In LCA natural resources represent one of the areas of protection (next to natural environment and human health). The impact related to resource use is assessed through different methods, in which limitations to the accessibility due to geopolitical reasons are usually not taken into account. The need of taking into account in LCA the economic and geopolitical aspects that can reduce resource availability has been acknowledged (Schneider et al. 2011; Mancini et al. in press). It is, however, also debated if the aspect of resource security of supply, or even socio-economic issues in general, should be accounted in so-called (environmental) e-LCA or in a (social) s-LCA (Mancini et al. 2013). An example proposal for including this concept in e-LCA is reported in Schneider (2014), where the Economic Scarcity Potential (ESP) is proposed as an aggregate indicator. It gathers eight different aspects related to the resource security (including governance, concentration of supply, application of trade barriers, demand growth, etc.) and setting thresholds of risk. EPS was calculated for 17 metals.

2. Inclusion of criticality in supply chain analysis

Having information on the use of critical resources in supply chains is very useful in eco-design contexts and policy making. This information can support and guide the minimization of CRM use, or maximization of benefits from them, their recovery in waste management and substitution. As security of supply is a socio-economic aspect, it is questionable if it should be accounted in the e-LCA (which includes a dedicated area of protection on natural resources) or in the s-LCA (where social impacts are addressed). We argue that even if the use of critical raw materials does not constitute an environmental issue per se, the current framework of e-LCA, accounting inputs and outputs in the supply chain, is most suitable for assessing the impacts linked to the use of physical resources. Indeed, the inventoried flows are measured in mass unit in e-LCA, while in the s-LCA the inventory data are accounted in dollars or working hours.

LC inventories could be readily used to analyse the use of CRM along the life cycle, relying on the outcomes of governmental critical raw material assessments. At impact assessment level indicators used for the assessment of criticality can be applied to develop characterization factors for the impact category “resource security”. As outlined in Mancini et al. (2013), the main methodological hurdles and inconsistencies that have to be faced in this operation consist of: (i) the “relativity” of the criticality assessment (generally referred to a subject, a geographical region, a timeframe); (ii) the presence of elements of subjectivity (i.e. thresholds are set to establish which

materials are critical); (iii) the temporary nature of the assessments (the condition of criticality can quickly change over time, even in the short run).

Proposal for the inclusion of criticality in LCA

The methodology for the identification of CRMs for the European Union combines two main variables: economic importance (EI) and supply risk due to poor governance (SR_{WGI}). The latter encompasses four sub-components: (1) level of concentration of worldwide production of raw materials (using the *Herfindahl-Hirschman Index* (HHI)); (2) political and economic stability of the producing countries (using the *Worldwide Governance Indicator*); (3) potential of substitution of the raw materials (estimated through experts' opinion); (4) recycling rate (considering the shares of EU consumption of raw materials addressed through secondary materials). A group of experts defined criticality thresholds for SR_{WGI} and EI values, which outline an area of criticality; the materials located in this area are defined as CRMs. (EC - European Commission 2014).

We argue that SR_{WGI} data provided in the EC study on CRM could be used in LCA for evaluating resources consumed in a product's life cycle in terms of resource security. In the impact assessment phase, the amounts of resources used in the supply chain (composing the inventory) can be multiplied for the SR_{WGI} factor, providing an indicator of the total resource security impact. This information could complement the existing indicator on resource depletion that does not take into account the access to resources.

The choice of supply risk as indicator allows overcoming the methodological hurdles listed above: (i) the indicators that compose SR_{WGI} (e.g. WGI and HHI) are calculated at global level (while the EI is assessed at EU level), or are based on expert judgment; recycling rate is assessed through shares of EU consumption, but these values could be substituted with global estimates on recycling rates provided by UNEP (Unep and International Resource Panel 2011) (ii) no thresholds or other subjective elements are included in this indicator (iii) frequent updates of the CFs could provide consistent assessments.

Implementation options and testing example

In LC impact assessment the input/output flows compiled in the inventory of materials consumed and emissions are quantified in terms of indicators through characterization factors¹ (CFs). An emission or resource flow is multiplied by a factor to give an indicator. The nature of the indicators varies, some reflecting contributions to impacts, risks, or pressures; some reflecting environment, health, and/or socio-economic considerations.

1 Factor derived from a characterization model which is applied to convert an assigned life cycle inventory analysis result to the common unit of the impact category indicator (EC - European Commission 2011c)

SRWGI data provided in the CRM study for EU could be used as CFs in a new impact category called “resource security”. However, the SRWGI dataset has a low variability, and the relative difference between materials in terms of security would be not well represented if these values are applied as linear weighting factors.

In order to obtain factors that could better represent the supply risk, two different options could be envisaged:

- raising the values with an exponent, that could spread the resulting values in a wider range
- dividing the values of supply risk by a measure of the size of the market, e.g. the world mine production in a given year, in order to assign more importance to specialty materials having small markets.

Three methodological options have been tested using an example dataset:

- baseline option: SRWGI values as such
- option 1: $(SRWGI)^6$
- option 2: $SRWGI / \text{world mine production in 2011}^2$

A further option is to use the list of CRM published by the EC and apply a binary variable as CF, that assign the value 1 for the materials included in the list as critical and 0 to the non-critical ones.

The product used for testing the different options is a multi-crystalline silicon photovoltaic (PV) panel of one square metre and weight of 26 kg. The inventory includes the following raw materials: silicon, silver, aluminium, chromium, cast iron, copper, manganese, magnesium, zinc (Jungbluth et al., 2009).

Table 1 presents the results of applying the different options of CF based on SRWGI. It also includes information on the CFs resulting from the three methodological options and the amount of raw materials included in the inventory.

In terms of mass, aluminium and silicon are the most important raw materials. CFs have the same ranks in the baseline and option 1, with magnesium and silicon having the highest CF; in option 2, where mine production is taken into account, the ranking is different and silver has the highest CF.

In terms of impact result, figure 1 presents a contribution analysis of the total impact calculated with different CF sets, next to the contribution of the different metals in terms of mass and the “binary approach”. In the baseline case, the contribution of silicon is the most relevant, followed by aluminium. This reflects the contribution of the raw materials in terms of mass, even though in this case the order is inverted. Using the CF from the option 1, i.e. applying the exponent 6 to the SRWGI values, the materials with the higher supply risk factor pop up, while the amount of material used has less importance; indeed magnesium is the most relevant contributor to the total

² Data on mine production are from USGS (US Geological Survey 2011)

impact. It is noted that the choice of the exponent is arbitrary, and the variability of the results increases as higher exponents are applied, as well as the distance between the minimum and the maximum value. In this exercise the exponent 6 is chosen as an example. But, this choice is not underpinned by a biophysical law or scientific evidence. The choice rather depends on the importance one wants to assign to the risk (instead of the mass). In option 2 the supply risk relates to the size of the market, using data on mine production in 2011. This allows highlighting the materials that are used in small amounts over the bulk materials. Therefore silver has a more relevant contribution (in spite of its low mass in the inventory), together with silicon and magnesium. Due to the incomplete statistics on magnesium production (that do not include US mine production), the figure on magnesium production is underestimated and therefore the CF2 and the related impact are overestimated. In the binary approach all the impact is due to silicon and magnesium; using this approach all the materials that are not critical in the EU list are cut off, even if they have high risk values and are very close to the criticality threshold. From the other side, this method accurately reflects the policy priorities on raw materials.

Table 1: Resource security impact assessment results of a PV panel (1m²)

Material	Input flow	Resource security impact			Characterization factors		
	mass (kg)	Baseline	SR1	SR2	CF baseline	CF 1	CF2
Silicon	1.545	2.52	28.98	3.15E-07	1.63	1.88E+01	1.40E-11
Silver	0.009	0.01	0.23	2.73E-07	0.73	1.51E-01	8.42E+00
Aluminum	2.537	1.09	0.01	2.47E-08	0.43	6.32E-03	2.53E-05
Chromium	0.008	0.01	1.64	3.37E-10	1.01	1.06E+00	4.43E-04
Cast iron	0.011	0.01	0.02	1.91E-12	0.5	1.56E-02	1.66E-06
Copper	0.115	0.03	0.00	1.58E-09	0.22	1.13E-04	2.50E-03
Manganese	0.013	0.01	0.01	4.10E-10	0.43	6.32E-03	2.35E-05
Magnesium*	0.080	0.20	405.27	2.60E-07	2.53	2.62E+02	2.48E-06
Zinc	0.005	0.00	0.01	1.94E-10	0.45	8.30E-03	3.65E-03

* USGS statistics for magnesium production do not include US production; therefore the CF2 is overestimated

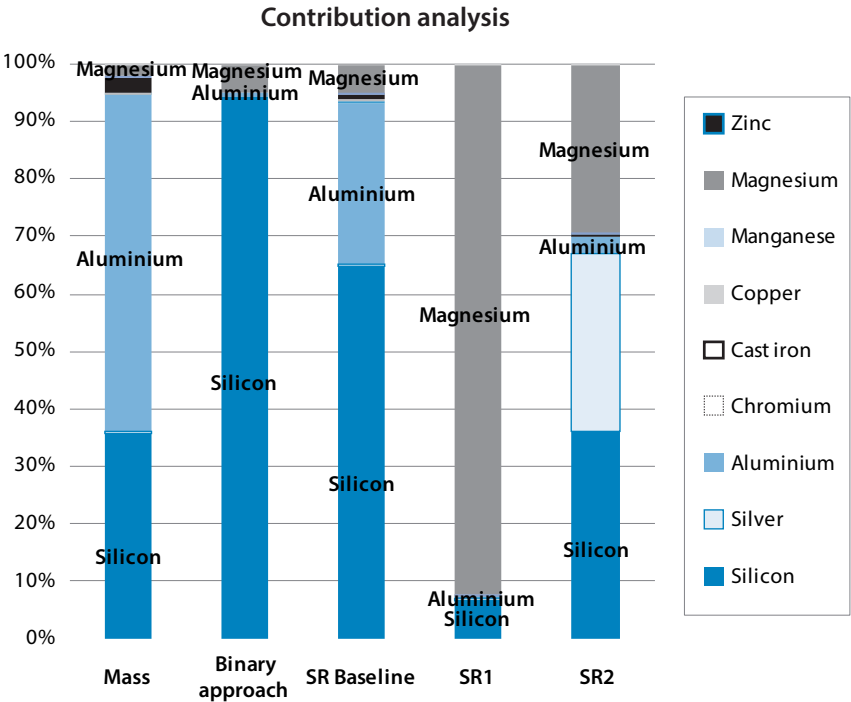


Figure 1: contribution analysis from different options for characterization

3. Conclusions

This paper suggests that so-called environmental-LCA is well positioned to include resource criticality considerations; essentially a socio-economic indicator. Separate consideration in social LCA, in relation to human flows related to product life cycles, is not needed for this particular calculation.

Different options for the calculation of resource security impact have been shown, and the outcomes of the different choices are illustrated through an example on a PV panel. Data on supply risk due to low governance used as characterization factors (baseline) does not well represent the relative difference in raw materials security, and the impact depends mainly on the masses. Applying an exponent to the supply risk dataset the values are spread on a wider range and the impact depends more on the

risk factor. The choice of an exponent is arbitrary and arguable; therefore it could be established in a stakeholder consultation.

In the third option the supply risk is related to the annual mine production, which indicates the market size; this method gives more importance to specialty metals. Using a 0/1 variable for calculating the impact leads to the consideration of the materials that are defined as critical in the list published by the European Commission and the exclusion of the non-critical ones, even if their value of risk is very close to the thresholds.

Even though the choice of an option over the others is not possible at this stage and more implementation examples are needed, this exercise is expected to contribute to the discussion on the inclusion of criticality in LCA. Further analysis could be conducted including also the economic importance of materials, and comparing results with other LCIA methods and indicators.

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Estimating health effects of income inequality changes caused by life cycles: a study at the subnational level

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1. Context and scope

To compare the social impacts of different life cycles providing the same service, several alternatives are available. One can ask experts or different groups of actors involved, their opinion regarding the social impacts of different scenarios. One can also gather information from actors of the life cycle about how they feel and what they attribute to the life cycle they are involved in. However, due to the way these approaches are developed, the nature of the social impacts assessed is difficult to generalize.

Building on the generic solution developed in environmental LCA, we propose another approach, which consists in using formalized relationships that allow anticipating social impacts under certain conditions. The literature on social LCA (for example Parent et al., 2010) calls this the impact pathways approach.

Social outcomes that we consider are those that affect human well-being, health in particular. Epidemiologists agree that the determinants of collective health are first socio-economic (McCartney et al. 2013). The level of economic activity measured through the GDP of a country is one of the major determinants first showed by the American demographer Samuel H. Preston (Preston, 1975). Using the relation of Preston, Feschet et al. (2012) proposed the “Preston pathway” highlighting for poor countries, the long-term impacts on average life expectancy of an increase in average incomes resulting from a variation in the production stage of a life cycle.

The work described here, refers to another pathway, the “Wilkinson pathway” in reference to the work of the British epidemiologist Richard G. Wilkinson and his colleagues on the relationship between income inequality and health (Wilkinson and Pickett, 2010). This pathway proves to be particularly relevant to social LCA, since income inequality has significantly increased in many developed countries (as a result of the stagnation of economic growth: Genevey et al., 2013) and forces decision makers to try to restrain it in order to limit its social drawbacks.

The “Wilkinson pathway” allows quantifying the consequences of changes in a life cycle on income inequality and infant mortality. We first used this pathway to quantify the consequences at a country level arguing that there are life cycles that can generate important socioeconomic changes at a nation scale (article forthcoming in the International Journal of Life Cycle Assessment). However, in the interest of countries and companies, the real stake of calculating the effects of changes in a life cycle on income inequality and health is mainly at a more local scale. Indeed, the effects of an ordinary life cycle will in proportion be more important in a region than in the country where this region is located.

Income inequality affects health through various materialistic and psychosocial mechanisms (Biggs et al., 2010; Yang et al., 2012; Qi, 2012). Based on these theoretical thoughts, many researchers have attempted to measure income inequality – health relationship at various scales (national and subnational). Recent studies at municipalities, provinces and other local communities scales showed a negative correlation between income inequality and individuals’ self-rated health (Rajan et al., 2013; Rostila et al., 2012; Edvinsson et al., 2013; Chiavegatto Filho et al., 2012; Feng et al., 2012; Franzini and Giannoni, 2010; Ichida et al., 2009).

However, the above studies are often limited by the lack or insufficiency of data. Hopefully, the possibilities expand as more data becomes available and econometric models improve.

Drawing on the recent works of Rostila et al. (2012) on the municipalities of Stockholm (Sweden), our ongoing work aims to retest the above relationship in other regions using the most recent and longitudinal data as well as the most appropriate models. We will thereafter explicit how the relationship is used to build an impact pathway for social LCA.

2. The income inequality – health relationship at the subnational level: main findings

At the subnational level, population health is most of the time measured through self-reporting questionnaires, which can be used as a proxy of mortality within a population as demonstrated by Burström and Fredlund (2001).

The first main finding which is consistent among recent studies is that in areas with political autonomy in the implementation of public goods, more income inequality is associated with more self-reported health problems (Rajan et al., 2013; Rostila et al., 2012; Edvinsson et al., 2013; Chiavegatto Filho et al., 2012; Feng et al., 2012; Franzini and Giannoni, 2010; Ichida et al., 2009). This result has been found in different countries at scales as various as municipalities, regions, districts and provinces, after controlling for multilevel socioeconomic characteristics such as demographic characteristics,

individual income, average community income, etc. The relationship is significant even within the most egalitarian societies as showed by the recent studies of Rostila et al. (2012) in Sweden. It might however be stronger in more unequal societies as reported by Kondo et al. (2012).

Moreover, like at the country level where it has been shown that health system variables attenuate the effect of income inequality on infant mortality (Macinko et al., 2004), it has also been shown that at the subnational level the correlation between income inequality and self-rated health tends to disappear after adjusting for spending on social goods. At the subnational level, Rostila et al. (2012) tested for example the effect of spending per capita on infrastructure, leisure, education, eldercare, family and work whereas Franzini and Giannoni (2010) tested the effect of living conditions, healthcare and social isolation. Both studies found that the effect of income inequality on self rated health ceases when the endowments in social goods are taken into account (controlled for). Franzini and Giannoni (2010) explain the mechanisms through which poor living conditions affect self-rated health as follows: *"The stress of daily life is increased by hassles such as difficulty parking, traffic, living away from family and poor public services... Poor quality housing and poor conditions of public places can impact both physical health as well as mental wellbeing. For example, individuals living in small, overcrowded, and damp homes are more likely to get sick. So are those living on dirty streets, where trash collection may be infrequent. Pollution and poor water quality also have the potential for impacting physical health directly"* (Franzini and Giannoni, 2010).

The second main finding concerns small administrative entities, such as neighborhoods, which do not have the so-called political autonomy. Rostila et al. (2012) and Wong et al. (2009) for example, found respectively in the municipalities of Stockholm and in Hong Kong, no association between self-rated health and neighborhood income inequality after adjusting for various contextual factors (average local level income and other individual and household level predictors such as gender, age, marital status and income).

The contrasting findings between neighborhoods and other bigger administrative entities reveal the importance of paying attention to the level of aggregation when studying the effects of income inequality on health.

Despite the thorough research accomplished on the subject, authors draw attention to several limitations of their work. Obtaining more robust measures of the income inequality – health relationship that will be useful for social LCA, thus requires further work.

The first thing that needs to be improved is the type of datasets used for the analyses. The vast majority of the recent results are based on cross-sectional data, which prevents any causal inference. We therefore need to redo the estimations using time series data and applying the best econometric models available. Longitudinal data are indeed available in several developed countries. McLeod et al. (2003) for example used longitudinal health and socio-demographic data coming from several national surveys undertaken in Canada, but they combined these data with a static measure

of income inequality derived from the 1991 Canadian census. Yet, it is very likely that the Gini coefficient, which is the most common and comparable income inequality measure, is calculated for different geographic levels, in most developed countries.

Our idea is to retest the relationship at various subnational scales, using both longitudinal health and income inequality data from Canada. Retesting the relationship at different subnational scales will help defining the area sizes for which a significant effect is observed. Indeed, whether a geographic area has or not a political autonomy, as mentioned above, may be an insufficient criterion for the existence of a significant effect of inequality on health. A Norwegian study (Elstad et al., 2006) for example showed that when income inequality is considered with respect to small municipalities (population below 6000), no detrimental effect on mortality is observed, whereas this effect increases significantly at larger area scales (over 20,000 inhabitants).

Using longitudinal data will allow testing different time lags of the effect of income inequality on health in order to take into account the complex psychosocial and materialistic mechanisms underlying the relationship. Feng et al. (2012) found for example 3 to 6 years lagged effect of province level income inequality on self-rated health in China.

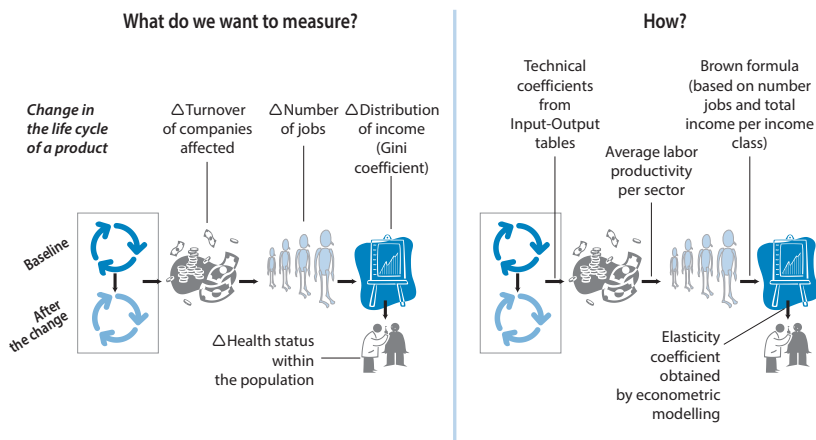
Also, as it has been shown that spending on social goods is an important determinant of the effect of income inequality on health in several countries (e.g. Sweden and Italy), it is important to check the robustness of this finding by testing in depth the role of each social good individually (health, education, housing, etc.) for which proxies are available in the current datasets. We would in particular, like to characterize the amount and nature of the social goods that compensate the adverse effect of income inequality on health.

Furthermore, because self-rated health is subjective and its assessment may vary according to cultural differences, it is important to study how it relates to other objective measures of health in different cultural contexts.

Finally, particular attention should be paid to the conditions of use of the income inequality – health relationship. In particular, it is important to keep in mind that the coefficient estimated econometrically from past data helps assessing only the likely effects (within a confidence interval), of actions that are undertaken today or will be undertaken in the future. Due to the data imperfections and the numerous assumptions made during the modeling – for instance the standard assumption in economics that all else remains equal (*ceteris paribus*) – we reasonably cannot expect interpreting the results in absolute terms. By comparing two alternatives with the same hypotheses, imperfect models and uncertainties, it is hoped that the difference between the two will have more meaning.

3. Building an impact pathway in social LCA using the above relationship

Once the income inequality – health relationship estimated and the conditions of use well defined, it becomes possible to use it to assess the likely effects on health of different scenarios of change in a life cycle. A complete pathway could be the one represented in the figure below. Already tested at country level, this pathway could also work for certain subnational levels such as regions or provinces where similar tools, such as input-output tables (IOT), and indicators are available.



Estimating the values of the different indicators involved in the pathway requires following four major steps: (i) estimate the flows of turnover created or destroyed by the change in the life cycle in the different subsectors of the economy using the technical coefficients derived from the IOT (one may here suppose a constant return to scale or choose a different assumption); (ii) deduce from that, the number of jobs created or destroyed in the different subsectors using average labor productivity per sector; (iii) estimate the new Gini coefficient following the change and calculate the variation compared to the baseline; (iv) use the elasticity coefficient estimated econometrically to calculate the repercussion on the health variable (one must first ensure that the conditions of use accompanying the elasticity coefficient are met).

It might be some cases where IOT are not available at a disaggregated level. The immediate alternative described by Garrabé (2008) is to empirically identify and quantify the effects of an action (for example a new expenditure) from the various iterations of the process within the production chains. The second alternative is to use the multipliers method. These multipliers could be either of demand (effects of

households' expenditures), supply (effects of local production of companies), or public spending. They should be articulated to help provide meaningful information about the consequences in terms of total activity created by an autonomous expenditure.

4. Conclusion

Social LCA is in the very early steps of its construction and despite the thorough work that has already been accomplished, further work is needed in order to be able to measure social impacts with a good deal of precision. The impact pathways approach contributes to this objective.

Much effort is needed especially to ensure the robustness of relevant socioeconomic relationships. This requires getting back a little bit to research as we cannot just build on reports of international organizations and presume the existence and robustness of relationships that have not been systematically tested.

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Implementation of socioeconomic criteria for the life cycle sustainability assessment of housing retrofit

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1. Context and scope

In the European context, most of the housing stock must be renovated. Reaching the environmental targets and reducing energy dependence has been focused by policies and regulations [1]. Sustainable renovation entails numerous positive effects on society, dealing with poor conditions of dwellings and keeping the cultural heritage. However, retrofitting might also entail unexpected negative repercussions on health (such as worsen air quality due to the increased air-tightness) or increasing social inequalities [2]. Incentive instruments are necessary to foster retrofitting, and decision-makers need holistic assessment methods to identify renovation practices to encourage: solutions being optimal from the environmental and socioeconomic point of view throughout the whole life cycle.

Life cycle sustainability assessment (LCSA) is an assessment technique that aims at integrating environmental life cycle assessment (LCA hereafter), social LCA and life cycle costing (LCC) [3]. This technique is still very recent, and not developed enough to be applied to assess housing renovation works. The environmental LCA has been widely developed and applied. Also LCC, but applications often disregard externalities and some of the life stages. Social LCA is the most recent methodology and application is still challenging.

Main developments in social LCA are the standard EN 15643-3:2012 for the assessment of buildings [4] and UNEP/SETAC guidelines and methodological sheets for products [5]. On the other hand, building assessment tools are increasingly including socioeconomic aspects. All these references propose socioeconomic criteria to be assessed. Classification varies depending on the source (by topic, stakeholders, categories, etc.). Life cycle stages are not equally covered: the current version of standard EN 15643-3:2012 only applies to the use phase of buildings and the UNEP/SETAC guidelines and methodological sheets only to the production phase. Specific indicators are not standardized, but only suggested in the draft for the future standard prEN 16309, as well as in the UNEP/SETAC methodological sheets. None of the

previously mentioned references specifies how to calculate impacts. As presented by Parent et al. [6], most applications (to date) assess relative performances in a scoring scale by comparing to reference points (usually a range between the minimum acceptable value and the ideal situation). Although some approaches exist [7], models for the calculation of impacts are still lacking in social LCA.

2. Goal and approach

This work aims the development of the life cycle sustainability assessment methodology. The goal is to assist decision making in the specific context of Brussels-Capital region towards more sustainable housing retrofitting practices. Since the environmental part has been largely developed by the environmental LCA, the challenge is to add relevant socioeconomic aspects into the methodology.

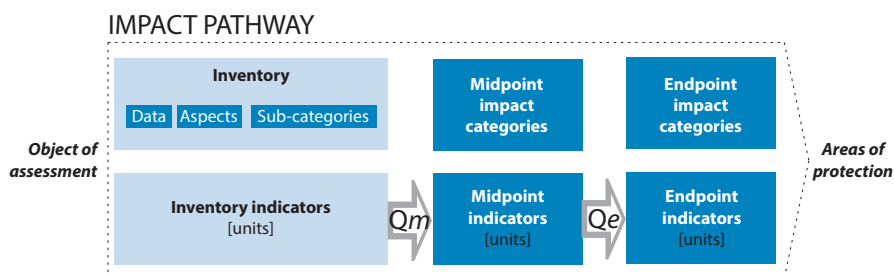


Figure 1: Impact pathway terminology and structure (own elaboration)

In order to ensure the coherence of the methodology, this proposal has been developed similarly to environmental LCA. That is following the so called impact pathway. In LCA, pathway is divided in inventory, midpoint and endpoint impact categories (Figure 1). For socioeconomic issues, this proposal also classifies inventory in sub-categories, aspects and data. Indicators (and related units) have been defined to quantify inventory and impact categories. Characterization factors (Q_m and Q_e in Figure 1) have also been defined to calculate indicators, from the inventory into midpoints (Q_m), and from midpoints into endpoints (Q_e). Some of the midpoint categories and subcategories are characterized with more than one indicator.

Indicators proposed for the life cycle inventory assessment (LCI) are presented in 2.1., characterization models for the life cycle impact assessment or LCIA in 2.2, and discussion and conclusions in 2.3.

2.1 Life cycle inventory assessment (LCI)

In order to perform the life cycle inventory analysis (LCI), our proposal defines socioeconomic inventory indicators and units of measurement. As it has been mentioned before, socioeconomic inventory is classified in levels, here called subcategories, aspects and inventory data. This classification is useful to organize and structure the methodology.

After being adapted to the case of housing and retrofitting (and therefore dismissing the non-applying criteria), most of the social performance categories and subcategories defined in the main reference documents (EN 15643-3, prEN 16309, UNEP/SETAC guidelines) have been included in our proposal (top-down approach). The analysis of the specific context of housing renovation in Brussels-Capital region identified relevant socio-economic issues (bottom-up approach) such as the high unemployment rates and consequent deteriorated working conditions, poor housing stock conditions, unaffordable retrofitting, rates of households in fuel poverty¹, or population increase. These issues were identified not to be addressed by reviewed references, and new indicators have been developed to include them.

By following these top-down and bottom-up approaches, the LCI proposal consists of 21 impact subcategories, 48 aspects, and more than 100 inventory data and sub-data). These criteria are classified by categories "Accessibility", "Adaptability", "Health and comfort", and "Safety and security", "Decent living conditions", "Cultural value", "Development", "Endogen development", and "Sourcing of materials and services".

Indicators, with related units, characterize the inventory. Figure 2 and 3 show inventory indicators and sub-indicators related with health and prosperity. Sub-indicators are necessary to calculate inventory indicators when more than one parameter is involved. From these inventory indicators, midpoint and endpoint impacts are calculated by using characterization factors.

2.2 Life cycle impact assessment (LCIA)

Impacts on sustainability are considered damages to the so called areas of protection. These are natural resources², biodiversity², human health², social well-being³, human dignity³, and cultural heritage⁴. For the first three, endpoint indicators (and units) are accepted by the LCA scientific community, that is: damage to natural resources (in surplus cost), damage to biodiversity (in species year), and damage to human health (in disability-adjusted life years or DALY)². For "Social well-being", "Human dignity" and "Cultural heritage", the level of agreement is not enough yet. However, the relation between economic prosperity and these three last areas of protection is well

1 "Fuel poverty" defines the household inability to keep the home adequately warm at an affordable cost, as a result of low household income, poor heating and insulation standards, and high energy prices. www.fuel-poverty.org

2 Largely accepted in LCA. For example in ReCiPe method www.lcia-recipe.net/

3 Proposed by Weidema [7]

4 Proposed by the UNEP/SETAC life cycle initiative www.lifecycleinitiative.org

recognized. “Prosperity” seems thus to be a suitable endpoint indicator to assess well-being, human dignity and cultural heritage.

For the impact assessment phase, our proposal defines characterization factors to model pathways relating retrofitting works and impacts on health and on economic prosperity, from inventory indicators to midpoint impacts, and from midpoint to endpoint impacts. As Figure 2 shows, impacts on health related with retrofitting are caused by the so-called “environmental health”, “occupational health”, and “user health”. Prosperity (Figure 3) is considered at the level of society at large in terms of fairness, at the level of the Region in terms of economic growth, and at the household level, in terms of affordability of decent living conditions.

Environmental health (defined in environmental LCA) is affected by emissions to the environment due to material production, disposed materials, operating energy, etc.; **Occupational health** is mainly affected by safe & healthy working conditions. These depend on the sector and country of origin, and on the type of works on site; **User health** is mainly affected by indoor air quality and adequate indoor temperatures. Several and diverse parameters are involved in these inventory indicators. Some of them are related to the type of materials employed (such as emission rate of indoor finishing materials, hygrothermal fabric performance), with technical systems (type of combustion sources, ventilation rate), but also with the household situation (low household income), or a combination of them. For example, the condition of a household to be in fuel poverty is caused by a combination of high energy costs, energy inefficient housing, and low household income. Effects of fuel poor households on health are due to inadequate indoor temperatures and presence of mould and dampness.

Characterization factors are established between inventory and midpoint indicators, and between midpoint and endpoint indicators. Some pathways are very straight forward. This is the case for safe and healthy working conditions [7]: characterization factors multiply incidence (based on statistics and international reports), severity of the disease (0-full health, 1-death), and duration (in working hours). Indicators to characterize the midpoint impact category of occupational health are years of life lost (YLL), and years of life disabled (YLD). Characterization factor to calculate the endpoint impact sums up both units, obtaining result in DALY.

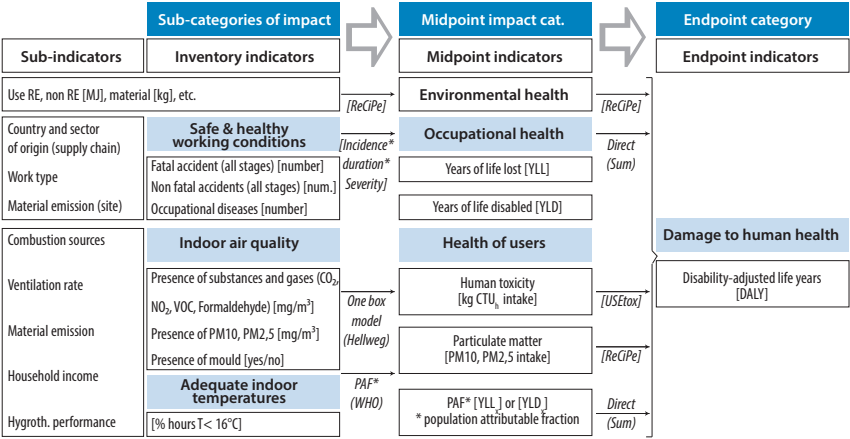


Figure 2: Impact pathways related to health (own elaboration)

Two ways are proposed to model effects on user health. One is based on recent research for the integration of indoor and outdoor toxicity. It is headed by the UNEP/SETAC life cycle initiative, and based on Hellweg's "one box model" [8]. It calculates intake fraction (in comparative units of toxicity CTU_h), by considering the emission rate of finishing materials, ventilation and metabolic activity. Damage on health is calculated with USEtox method⁵, based on the intake and effect factor. This would be used for VOC and formaldehyde concentration. The other characterization model is based on the WHO mechanism to calculate the environmental burden of disease [9], used to calculate effects on health caused by the presence of mould and other substances, and by inadequate indoor temperatures. It is based on the population attributable fraction (PAF), based on the relative risk and proportion of people exposed. Midpoint indicators are expressed in years of life lost and years of life disabled due to every different disease (e.g. YLD_{asthma}). Damage to human health (in DALY) is the sum of the different results.

Prosperity of society depends on the job creation and fair salary ensured. It is mainly related with the sector and country of origin of materials and products involved across the supply chain, and data are provided by international reports and statistics. Burden is attributed by working hours employed in the production stages; **Region's prosperity** related with retrofitting works depends on the monetary entries and exits, such as (avoided) aids to unemployment, contribution to social security of workers, subsidies to retrofitting, VAT of products and services, VAT missing due to energy savings, and rehousing costs (for social housing); **Prosperity of households** depends

5 The USEtox model has been developed by the USEtox Team, a team of international researchers from the Task Force on Toxic Impacts under the auspices of UNEP/SETAC Life Cycle Initiative. www.usetox.org

on the affordability to ensure decent living conditions, such as economic accessibility to invest on retrofitting (including rehousing) in the case of private ownership, but also affordability of operation and maintenance cost.

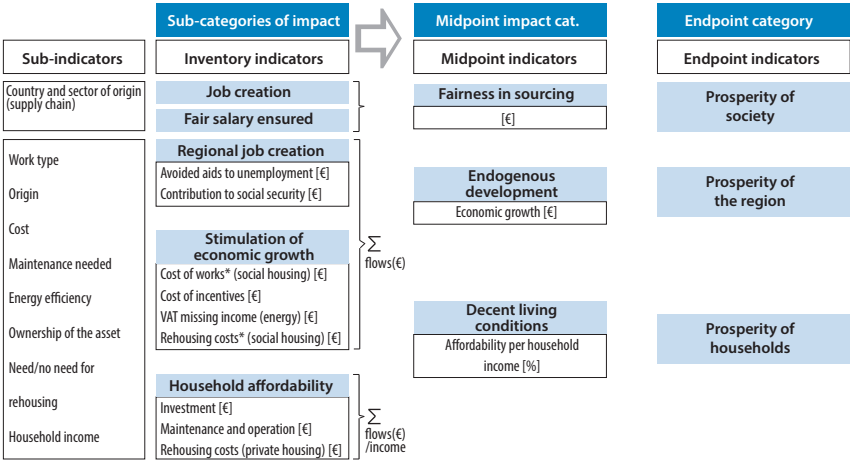


Figure 3: Impact pathways related to prosperity (own elaboration)

3. Discussion and conclusions

Since human health is the area of protection where environmental and socioeconomic life cycle assessment overlap, modeling the complete pathway enables the integration of both issues in a comprehensive analysis. Potential double counting or burden shifting is thus avoided. By driving the assessment until the endpoint indicator “damage to human health” in DALY units, results of different pathways can be aggregated with no weighting.

The association between retrofitting projects and impacts on social well-being and human dignity can be established, but specific characterization factors to quantify them seem still far to be defined. Indicators for cultural value are lacking (in Brussels, heritage seems to be ad-hoc analysis rather than indicator-based methodology).

Although prosperity indicators do not quantify well-being, dignity or cultural value, promoting retrofitting practices with the best impacts on prosperity at the three levels without aggregation (society at large, Region and household’s) ensures positive

effects on these three areas of protection. Since the goal of this development is to assist decision-making in retrofitting (strongly related to incentive instruments), economic prosperity in terms of fairness, growth and affordability is essential to be considered.

This research establishes the baseline for further full applications of life cycle sustainability assessments. Although still challenging, modeling socioeconomic impact pathways is necessary to perform complete LCSA. Application enables the identification of priorities in retrofitting, or the optimization of incentive instruments.

4. Acknowledgement

This research is funded by the Brussels Capital Region through the INNOVIRIS Strategic Platform Environment 2012 for the period 2013-2014.

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Combining risk alteration and benefit generation in Social LCA

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One arm of the field of Social LCA which is equipped with a significant data basis for its practice is the arm related to social risk identification and reduction. Social risks relate to a host of problematic impacts on people, at work and in the communities where work takes place.

As with environmental LCAs, social LCAs can be conducted in both a screening assessment mode and a more resource-intensive case-specific mode which includes gathering and use of primary data on the social risks associated with “foreground” processes in the life cycle. And as with environmental LCAs, one way to potentially bring about progress in relation to social risks is by selecting and designing products in ways that reduce the total negative consequences per functional unit – in this case, the total worker-hours at elevated risks in relation to a comprehensive set of social indicators.

A second important way to address social risks in product supply chains and life cycles is gathering data which demonstrates a lower-than-generic or lower-than-background level of risk. And a third important way to address social risks is by actively introducing certification of compliant working conditions to processes which lack them.

But all of the above relates to risk reduction. There is another powerful dynamic possible in the design and expansion of product supply chains, particularly in contexts where economic opportunities are very low so that poverty and the risk of its related negative consequences are high. This dynamic is the introduction of social benefits of positive employment and community-scale benefits to such contexts.

This paper will present the results of a real-world case study that combines precisely these two different forms of social impact into a life cycle assessment: social risk alteration and social benefit generation. The case study involves the introduction of new production activities which are organized in ways that bring carefully documented increases to wages, working conditions, and several important community-scale public health-related indicators. The study also combines and applies primary and secondary social risk data for alternative product systems and their supply chains.

Social LCIA (impact assessment) methodologies are proposed and demonstrated for integrating these two forms of impact – risk reduction and benefit generation – into the social life cycle assessment of products.

Reference

Guidelines for Social Life Cycle Assessment of Products UNEP/SETAC Life Cycle Initiative on Integration of Social Criteria in Life Cycle Assessment. 2009



Session 5

Methods to enrich social LCA

SLCA scenarios: engaging producers and consumers in new domestic oyster value chains in Denmark

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1. Context and scope

Efforts to develop a Social LCA methodology target the need to account for social impacts in the life cycle of existing products. Most often, the objective is to provide scientific support for decisions on alternative suppliers and terms of governance in the value chain of a particular product. This paper suggests an application which shifts the focus to the design phase of life cycles of products and services yet to be constructed, not by a major lead company, but rather by start-ups and community groups.

Health concerns and negative environmental impacts of industrial food production motivate the development and testing of new systems of growing, distribution and consumption. Ecological farmers contest conventional production methods, home delivery of fresh vegetables bypasses physical markets, and new food paradigms change meal preparation and dining experiences.

One example is the entrepreneurs, NGOs and consumers setting up urban farming projects. One project attracting particular attention concerns maritime gardening: the growing, harvesting and eating of native oysters in the harbour of Copenhagen. The shift to container transport has deserted large dock areas in the harbour. Residential development along with new recreational spaces, including a public facility for swimming, is rising on the waterfront.

The experiments with oyster banks in the harbour are small in scale. Nonetheless, they may signal a broader trend of vertical value chains collapsing, as information and communication technologies allow consumers to produce, distribute and share on their own, thus transforming into *prosumers* (Rifkin 2014). Not much research has been conducted on these initiatives, and this paper refers to the outline of a planned research project only. The claim made in relation to Social LCA is that the nature of the oyster case points to further reformulation, as the discussion moves beyond what has been termed 'life cycle CSR' (Macombe 2013).



Figure 1: Vision of oysterbank above surface

During thousands of years, oysters were an essential food item for people settling in Southern Scandinavia. Today, Danes only consume a total of 50,000 oysters per year, the majority of which are imported. The native oysters fished in Limfjorden, Denmark, are mainly exported as high priced delicacies to Southern Europe.

Entrepreneurs and consumers groups in Denmark are experimenting with the development of new oyster value chains for a lower priced food product with high nutritional value in collaboration with the municipalities of Copenhagen, Ebeltoft and Fredericia. In a life cycle perspective, environmental and human health impacts of cultured oysters needs to be precisely assessed, value chain constraints must be addressed, and new business models developed. In addition and most importantly, prospective producers and consumers are engaging in participatory experiments on practices in farming, harvesting, distribution, and meal preparation and dining.

The move for “democratization” of oysters to increase domestic production and consumption targets aquaculture of oysters - the essence of ecological food - run as maritime kitchen gardens by an association of citizens, accompanied by pop-up oyster serving initiatives, encouraged through educational partnerships with schools and supported via trend-setting chefs and gourmet bloggers.

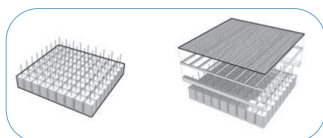
2. Main text

Aquaculture, the fastest growing sector in food production, is an attractive alternative to drastically declining fish stocks. It is now exceeding the wild fish supply for human consumption. Shellfish farming is considered as one of the most sustainable form of aquaculture, as it is organic extractive and not artificially fed like fish aquaculture.

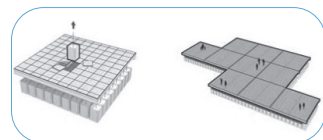
To increase the production volume of the native European flat oyster *Ostrea edulis*, Danish Shellfish Centre has developed methods to provide oyster seed all year round, thus reducing cost and removing one key constraint in the oyster value chain. To engage producers and consumers beyond the experimenting pioneers, positive health, environmental and social effects need to be validated and communicated.



Just below the surface, small oysters are placed in a basket. They grow in the water for 2-3 years; then are ready for harvesting. Several baskets are hanging on top of each other.



The baskets are joined together on a floating platform constructed in a way so that the baskets can be taken up and inspected.



On top of the platform, a swimming facility, a restaurant or a mini maritime experience centre can be built.

Figure 2: Growing of oysters below surface

The experiment in Copenhagen Harbour collapses a highly stratified production, distribution and consumption process into a much shorter and simplified life cycle situated in one locality only, and under the command of an association of citizens. As the oysters filter the polluted sea water, the regeneration of the water quality in the harbour accelerates and paves the way for new urban life spaces. Although a full ELCA has not been conducted, the pioneers are encouraged by this positive impact on the environment and claim that their design provides a range of potentially positive social impacts: oysters at reasonable cost are a nutritious addition to the daily diet; the activities throughout the life cycle of oysters provide learning and recreation for the families involved; and also a sense of community and belonging develops in the process.

In terms of human capital development, aquaculture - in particular under experimental conditions - requires a high level of managerial skills. However, according to Sen, this will be included in his broader concept of capabilities. The concept of human capital focuses on 'the agency of human beings - through skill and knowledge as well as effort - in augmenting production possibilities' (Sen 1997, 1959). Sen's concept of human

capabilities has a wider scope; he points to *'their direct relevance to the well-being and freedom of people; their indirect role through influencing economic production; and their indirect role through influencing social change'* (Sen 1997, 1960).

Tentatively, the list of ten central capabilities defined by Martha Nussbaum may be specified for the experimental oyster value chain (tableau 1).

However, the actual specification of relevant capabilities and how measure these must – in accordance with Sen's concept – be performed by those involved on the basis of what they consider as valuable functionings. Thus, suggested by several authors, e.g. by Syndhia Mathe (Mathe 2014), some form of participatory approach needs to be integrated into Social LCA to contextualize the assessment in terms of plurality of interests, local knowledge, diversity of social value judgements etc.

One important contribution towards the measurement of capabilities points the option for micro-foundations in normative assessments, *'the valuational foundation of the capability approach allows people to express their 'powers of discrimination' with regard to their well-being or to the good life'* (Comim et al. 2008, 180).

Table 1: Nussbaum's (2003) Ten Central Capabilities

	Capabilities	Definition (abbreviated)	Oyster value chain
1	Life	Live a life of normal length	
2	Bodily health	Incl. reproductive health, nourished, shelter	Contributes to a nutritional diet
3	Bodily integrity	Move freely, secure against violent assault	New, open recreational spaces
4	Senses, imagination, thought	Use as informed by education, not limited to basic training	Culinary, aesthetic and heritage experience
5	Emotions	Attachment to things and people	Associating with neighbours and others
6	Practical reason	Engage in critical reflection of one's life	Debate food and health issues
7	Affiliation	Show concern for other humans Social bases for self-respect	Be part of joint efforts to improve human well-being recognizing oneself and others as citizens
8	Other species	Concern for animals, plants, world of nature	Observe animal welfare and food ethics
9	Play	Being able to laugh, play, enjoy recreation	New community spaces for recreation
10	Control over one's environment	Participate effectively in political choices Property rights and right to employment on an equal basis	Ownership and command of value chain

The planned project on the oyster case proposes to apply Interactive Scenario Analysis, which is *'a method for creating scenarios that should be able to help stakeholders to navigate towards desirable futures'* (Baungaard Rasmussen 2011, 99). The method consists of five phases:

Constitutive phase	Definition of the focal issue. Planning of the physical facilities, time schedules and resources necessary to carry out the subsequent phases
Problem-focusing phase	The focal issue is divided and specified into several sub-issues.
Scenario-building phase	Scenarios are developed through an interactive and iterative process
Back-casting phase	Development paths are elaborated between the scenarios and the current situation
Action-planning phase	Strategies and action plans are developed

The suggestion is to integrate the assessment of social impacts as design criteria in the process of constructing the new oyster chain and its enabling context.

This outline indicates that new forms of value chains beyond those organised by the conventional, privately owned manufacturing company add to the challenge of relevance for Social LCA, as the Commissioner of study may very well be the citizens themselves

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Sustainability assessment integrated into a single score using monetization: case study on a can deposit system in Belgium

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1. Context and scope

In 2011, RDC Environment carried out a sustainability assessment for Belgian Public Authorities, through a combined environmental, social and economic life cycle assessment, in which all dimensions have been monetized.

The purpose of this Cost-Benefit Analysis (CBA) was to analyze and balance environmental, social and economic impacts to determine whether a deposit system for beverage cans would be globally beneficial or not for Belgium.

Such a deposit system already exists in some European countries, a.o. Germany and the Netherlands.

The first step consisted in quantifying the different impacts over the life cycle, without any integration, focusing on the following impacts for the current scenario and the prospective scenario (with deposit):

- **Social impacts:**
 - Job intensity along the life cycle.
 - Cleanness associated to reduced can litter.
- **Environmental impacts:** a set of classical impacts categories are analysed:
 - Climate change
 - Non-renewable resource depletion
 - Eutrophication
 - Acidification
- **Economic costs:** cost data was collected or estimated. Besides infrastructures and logistics, the study also includes consumer time and space required at retail points.

The second step consisted in the integration of all those indicators, using monetization, which enables to quantify negative and positive externalities. As economic costs are

already in euros, only social and environmental impacts need to be monetized. For each type of impact, there is a specific way, among those 3: (1) modeling of the chain of effect and valuation of end-points; (2) observed political valuation and (3) surveys on willingness-to-pay or accept for a felt effect.

- For the investigated social impacts, we will describe the methodology used for monetization:
 - Job creation is monetized according to the preference revealed by Public Authorities through subsidies for job creation.
 - For the disamenity associated to can litter, RDC Environment performed a local contingent valuation to determine the willingness to pay of the population to avoid such disamenity. We will namely describe the data collection process.
- The environmental impacts are assessed using RDC's internal life cycle assessment tool (RangelCA) and its monetization method. This allows environmental effects to be associated to human welfare changes expressed in euro. This methodology is presented in details in a public study we made for the French Ministry of Ecology and Sustainable Development. This will not be detailed in this presentation as it is only related to environmental aspects.

Finally, we will discuss the importance of sustainability assessment in the decision-making process and the influence of this study on the stakeholders' position.

2. Main text

Methodology to assess social impacts : job creation and litter

Job creation

Increase in employment rate is in many countries the main goal of economic policy. Evaluating this aspect is often compulsory for Public Authorities, in a sustainable development perspective.

To do so, the first step is to quantify the net job creation linked to the activity change, in Full-Time Equivalent (FTE). The term "net" means there is really an additional number of people working. Thus, job creation that merely shift activities or workers from a company to another, without increasing the labour market, are excluded.

In the can deposit case study, the analysis shows that all quantified jobs may be considered as net job creation. This job creation mainly arises at retail points and deposit sorting centres.

Creating a job is positive for the worker and for society. However, as policy making requires to weigh this aspect against other criteria, namely economic and

environmental impacts, it is relevant to evaluate in monetary terms the value for the society of a net job creation. The problem is complex, as taking into accounts all the costs and benefits for society implies the elaboration of a sophisticated model. Indeed, there is a large number of effects, including reduced expenses of social security, increased income for taxes, output of beneficiary work, better quality of life for the worker, better social cohesion...

To estimate the value of a net job creation from the perspective of the whole society, we use observed political valuation, making the following assumption:

Public Authorities take into account the social benefit (worker) and the societal benefit (society) when defining the subsidies for job creation. Thus, the value of a job is equal to the maximum amount of subsidy given for the creation of a job during one year. The maximum value is considered as Public Authorities would not spend this amount if higher than the societal value. Using the average value would be meaningless as only the minimum amount is given to achieve the goal.

However the reference subsidy should be selected with care for avoiding two possible biases in the valuation of societal benefits of job creation:

- **Deadweight:** there is a deadweight when the subsidy is used for a job that would have been created anyway. Consequently, the base value of a net job-year created is in fact higher than the amount of the subsidy allocated per person (ex: 2 jobs need to be subsidized for only 1 net job creation).
- **Feedback effect:** job creation generates an income for the State (income taxes, payroll taxes, avoided expenses for unemployment benefits...). For some subsidies, such an income may be taken into account when determining the budget. Consequently, the real value given by Public Authorities for job creation is in fact lower than the subsidy.

Therefore, the value retained by RDC is based on the subsidy given by the Walloon region (Belgium) for a reintegration program by work in a company. This subsidy minimizes not only deadweight, but also feedback effect. Indeed, deadweight is supposed very low as the profile of the people benefiting from this subsidy have great difficulty in finding a job, and would likely not have found any without this subsidy. Moreover, the feedback effect is also supposed to be reduced, as there is no direct link between the entity which offers the subsidy (regional authority) and the entity which gets the taxes on revenue (federal authority).

As a result, a value of **11 k€ per job-year** is used for expressing the societal externality of net job creation. It is obtained by dividing the amount of the subsidy by the time of the subsidy complemented by the expected time the person remains effectively working afterwards.

This value provides an order of magnitude that can be transferred to other geographical areas. Indeed, RDC Environment carried out previously an analysis on

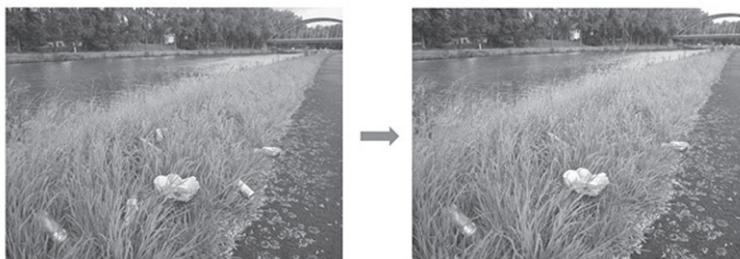
job creation valuation on the basis of subsidies in 16 European countries, USA and Canada. Accordingly, values of subsidies weighted by the GDP are quite constant among investigated countries.

Cleanness associated to reduced can litter

To quantify the disamenity associated with the presence of can litter in Belgium, RDC Environment performed a local contingent valuation to determine the willingness to pay of the population to avoid such a disamenity.

It consists in directly asking a representative sample of the population how much they would be willing to pay to live in an area without litter (or less litter). This method has been developed by the economic theory to allocate a monetary value to non-market goods.

The survey, conducted online on a sample of 1 000 people, staged landscape change through photographs of public spaces “before and after”.



The questionnaire, developed by RDC, was entrusted to an external service provider for completion of the investigation. Statistical and econometric treatment of survey data was used to check the consistency of data and eliminate outliers, such as false zeros. The result is a range of values of “willingness-to-pay” (WTP) expressed in € / inhabitant / year, directly used in the cost-benefit analysis on the deposit on cans.

Integration into a single score and related benefits

Balancing social impacts with other aspects is very challenging and decision-making often requires implicit arbitrary weighting between impacts.

If monetized, social impacts can easily be compared to monetized environmental and economic impacts, as they are additive and can be integrated into a single score in euro units.

Even though there may exist limitations in the model (data, modeling assumptions, geographical and temporal context) and all social aspects are not taken into account, monetization has the big advantage to make value judgments and assumptions explicit and to be much less penalizing than arbitrary weighting.

Moreover, by providing orders of magnitude of impacts, monetization allows data collection and modelling to be refined specifically for key points. The discussion focusses then on the uncertainties attached to these hotspots, which enhances the robustness of conclusions.



Results and discussion

Type of results : “Range graphs” to take into account uncertainty

Results are obtained with RDC’s internal life cycle assessment tool (Range LCA). The basic concept is that results must represent the diversity of individual cases, instead of considering an average case and a few alternative scenarios. In practice, variable parameters are modelled by attributing a probability of occurrence to their various possible values. The range of values represent either the diversity of situations (e.g. manual return of cans or use of a machine) or the uncertainty on a parameter (e.g. the labelling cost).

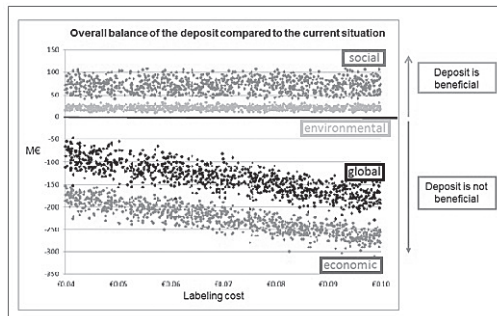
Results are presented in “Range graphs” as clouds of points. Each point represents one combination of variable parameters. The graph below shows the environmental, social and economic contributions to the global results. The benefit for the Belgian society (or welfare increase) of the introduction of a deposit system is plotted in function of an influencing parameter, the labelling cost per can. Positive values correspond to benefits (deposit is beneficial) while negative values refer to detrimental situations.

Main conclusions

The introduction of a deposit system for cans results in significant environmental and social benefits.

Among studied social impacts, the benefits of avoiding can litter is much higher than the benefits of job creation.

However, the cost of implementing the can deposit system exceeds in all cases the associated environmental and social benefits. This deposit system has hence globally detrimental effects on the Belgian welfare.



The labeling cost is a sensitive parameter for economic impact but not for environmental and social impacts. However, the hierarchy remains the same for all value sets. This means conclusions are robust.

Use of sustainability assessment to support decision-making at local level

This kind of integrated assessment is very useful to support policy makers in setting policies, both at national and local levels. The main advantages are the following: (1) it enables to take into account some social aspects over the life cycle in a holistic way; (2) it avoids to make arbitrary weighting between different types of impacts and (3) it enables to include local impacts in the quantitative evaluation process.

In this specific case, the loss of Human welfare due to economic cost outweighs the demonstrated social and environmental benefits. The Government decided not to implement such a can deposit. Such an approach can be applied for local projects like e.g. renovation of public buildings.

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The application of “ecoputation” to assessing the social effects associated with the life cycles of products and services-case studies in the heating of buidings

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1. Context and scope

Since assessing the social effects associated with the life cycles of products and services first entered the research agenda, two complementary approaches have been developed. The first seeks to explore the **social aspects of the behavior** of the companies involved in the life cycle, in order to help them to meet certain standards. The objective of the second approach is to **anticipate the social consequences** of changes to be brought about in life cycles. The latter case may be called “socio-innovation” (Call for papers, this seminar).

In this paper we discuss how the novel approach known as “ecoputation” may be applied to a case study involving heating from biomass and in particular, heating from biomass in buildings. A company involved in biomass distribution and sales, and biomass heat services engineering, is involved, both in: (1) social behavior within the biomass life cycle relating to the seeking of profit (e.g. by customer service); and (2) anticipation of the social consequences of changes to be brought about in life cycles relating to changing patterns of heat system engineering (e.g. by anticipation of the range of demand for good quality fuel). The objective in such situations should be to find an integration of the complementary approaches of “socio-innovation” and the meeting of standards.

2. Main text

A helpful first step is an integrated system diagram. In Figure 1, “profit-seeking social behavior” is exhibited in the cycle from profit through survey to biomass, shown in white on a black background. A survey of company staff is used to reveal the

company's criteria of acceptance of biomass profit. Complementary to the survey is its sustainability, shown in *italics*, while complementary to profit is that it should be economic, and complementary to biomass is its representation (type of timber, moisture level, etc).

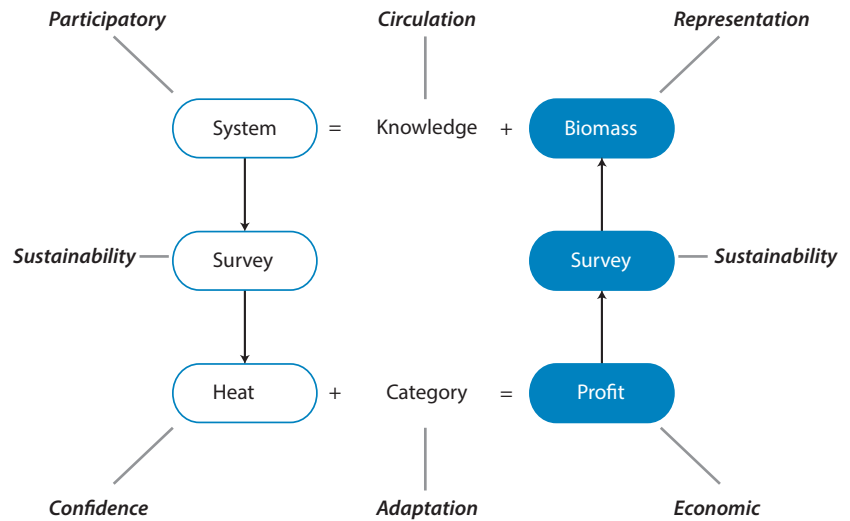


Figure 1: Optimisation of biomass profits and heat system process by survey.

On the left hand side of Figure 1, the “anticipation of the social consequences of changing patterns of heat system engineering” is exhibited in the cycle from system through survey to heat, shown in black on a white background. A survey, again with complementary sustainability, is used to reveal users’ criteria of acceptance of heat systems. Complementary to heat is confidence (for example, relating to weather and cost), while complementary to the system is that it is participatory. The system may be fully “life cycle” if it extends from biomass planting to ash disposal, but in this diagram it need not be and a boundary can be drawn, for example, at harvesting.

Between the left-hand and right-hand sides of Figure 1 there are connections. Knowledge is used to connect the biomass inputs to a known system; the knowledge may be circulated. Additionally, heat and effects on categories together make up profit. If heat is high (so that heat losses are low), then effects on categories will be lower as less biomass is burnt. The ‘categories’ here include both conventional LCA impact categories and resource depletion categories from the burning of the

biomass., as well as land use. If heat is lower (so that heat losses are higher), the effects on categories will be higher. Complementary to effects on categories are adaptations.

Some aspects of the two cycles are mutually reinforcing; for example a biomass which is both inexpensive to grow and harvest, and which has high calorific value. But some are not, for example customer service. There is, as the caption of Figure 1 indicates, an opportunity to use the surveys to optimize both biomass profits and the heat system simultaneously. But in order to do this, the aspects of the surveys, which are expressed in narrative, need to be numbered so that mathematical optimization can take place.

This is the point at which “ecoputation” becomes useful. “Ecoputation” is a methodology extended from Multiple Criteria Decision Analysis in which connected narratives (instead of disconnected criteria) with shared characteristics are deemed to belong to the same categories. The categories are numbered within a framework. The framework has a basic structure of words; these can be conjoined by mathematical mappings to yield longer narratives which are also numbered. “Ecoputation” is therefore possible, i.e. the development, presentation and communication of narrative information, including numeric information, by computational means. While LCA is optimized by computation, “Ecoputation” is not. Yet an optimization method is needed for both computation and ecoputation simultaneously. How this is best done is to be explored through this case study research.

The paper will assume no prior knowledge of “ecoputation”.

Regional Social Life Cycle Assessment of wood-based products

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1. Introduction

Nowadays, an increase in the future biomass-based production activities in Germany is expected, driven by the Bioeconomy Strategy, recently launched by the German government (BMBF 2011). The term bioeconomy describes the use of renewable resources for biobased material and energy, whereas residual streams are either further used in a cascade or recycled. The question of how the production of biobased products affects society has not been addressed sufficiently yet. In order to investigate social performance of biobased products in Germany, further research on context-specific sLCA methods is needed. The authors of this study argue that the regional context, to which the study is applied, determines the socio-economic aspects of importance for a sLCA method. For this a research approach to be applied for the development of context-specific impact categories and subcategories needs to be developed. The main objective of the overall study is to assess socio-economic impacts of production activities in a decentralised wood-based bioeconomy in Central Germany.

2. Determination of context-specific socio-economic sustainability elements

The country's development stage, its institutions (laws, regulations or informal rules), specific sector characteristics and the local environment of companies need to be analysed to define context-specific impact categories. Therefore, considerations on different levels – national, regional and sectoral – are required to increase context specificity of socio-economic opportunities and risks from level to level. This research approach showed in Figure 1 aims to identify a sustainability baseline for the production of wood-based products in Central Germany (Saxony, Saxony-Anhalt and Thuringia) in order to define context-specific impact categories. Hence, on one side socio-economic key issues as well as opportunities for sustainable development are identified on three different levels. They are determined by analysing socio-economic indices such as unemployment rates, income or population structure. As research

sources scientific papers and other documents such as companies' sustainability reports or official statistics are used. On the other side the approach involves a stakeholder analysis to firstly identify stakeholders which are potentially affected by production activities and secondly to conduct in-depth interviews with experts in the field on the different levels. Within the following steps first results from the proposed research approach are discussed. First, socio-economic issues or opportunities, identified on the different levels, are presented. Second, it is discussed how they potentially determine the selection of impact categories. Afterwards, it is shown how the stakeholder analysis can extend the previous analysis on the national, regional and sectoral level.

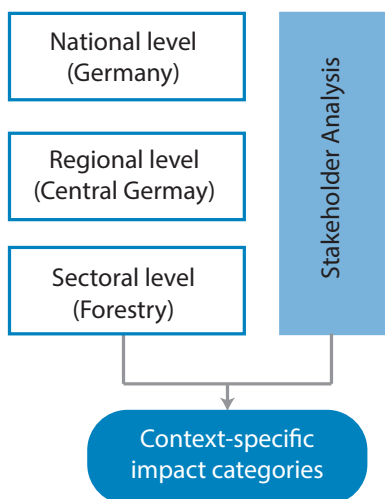


Figure 1: Determine context-specific impact categories

3. Results and Discussion

On the national level (Germany) several important aspects were identified: demographic change, long-term unemployment, gender pay gap, income inequalities as well as a lack of development in rural areas compared to cities (Statistisches Bundesamt 2012, Deutscher Bundestag 2013). Some relevant themes can be directly linked to products life cycles and thus be transferred into an impact category. For example, the gender pay gap can be directly linked to companies activities and can be transferred into the category discrimination. Other more general socio-economic

issues can, for instance, be linked by common companies measures which may lead to a sustainable development by counteracting future socio-economic issues. To mitigate the demographic change, for instance, adequate working time models for older employees are required in future. The legal system in Germany provides another specific example to how the context should determine the choice of adequate impact categories. In Germany legislation on minimum wage has not been passed until now. Thus, an impact category such as 'fair wage' cannot be defined by using a national minimum wage indicator in this case.

A further screening is done at the regional level (Central Germany); the geographic area where the production activities are located. Within this study the extraction of wood as well as main production activities take place in rural areas of Central Germany. In Central Germany the unemployment rate is with 9.6 percent above the average of Germany 6.9 percent (Bundesagentur für Arbeit 2014). The still existing regional differences between western Germany and the former eastern Germany are another context specificity which needs to be taken into account. Rural areas in the former East Germany are characterised by migration of young people. Within 2012 Saxony-Anhalt and Thuringia had the highest negative migration balance in Germany (Statistische Ämter des Bundes und der Länder 2013). Further, the demographic change will lead to a shrinking and aging population in rural areas. Thus, products life cycles creating employment in those areas have a positive impact on local development in short-term. Nevertheless, due to the decreasing population rate, qualified jobs are required in the long-term to maintain the rural areas. These specific socio-economic issues determine the selection of relevant socio-economic impact categories.

In order to contextualise the nature of relevant impact categories furthermore, a final sectoral analysis follows. The different life cycle stages such as harvest, transport and production can be linked to specific sectors. Hence, the sectors of the main production activities in the product life cycle are identified. As a wood-based bioeconomy depends on the local forestry sector as a raw material supplier it is of major importance for those considerations. But also the transport or wood manufacturing sector has to be integrated within the analysis. Based on this, appropriate categories are chosen which aim to advance sustainable development. To analyse the forestry sector regarding a sustainability baseline, national certification standards from the Forest Stewardship Council (FSC) or PEFC can be used to identify forest specific impact subcategories (FSC 2012, PEFC 2009). Generally speaking forest management concepts differ between forest ownership structures (state, municipal, private) and federal states. Some state-owned forests such as HessenForst, ForstBW, for example, have management concepts with specific sustainability goals and indicators (HMUELV 2012, ForstBW n.y.). However, to understand the status quo other information need to be taken into account. From a statistical analysis a rather high rate of fatal accidents in the forestry and agricultural sector besides the construction, traffic and service sector was identified (Baua 2012). Those data were validated by interviews indicating that using a harvester is more secure than motor-manual logging. These data may lead to a context-specific subcategory 'accidents during harvest'.

This stepwise analysis is accompanied by a stakeholder analysis. Actor groups were identified which are potentially affected by the production activities under study. Within in-depth interviews experts were asked for socio-economic issues within their respective fields. Within this study, representatives from the FSC and PEFC for instance on the national as well as regional level were interviewed. Further, representatives from local authorities e.g. from the Ministry of Science and Economy of Saxony-Anhalt and associations such as trade unions were asked. Information from the interviews, for example, lead to the conclusion that the private owned forest structure entails the highest risks for socio-economic sustainability.

It can be concluded that the level of development (national level) and the specific context e.g. the resource base has to be taken into account, in order to determine context-specific impact categories. In other words not only the sustainability baseline has to differ between countries, depending on its level of development, also impact categories need to be adapted to a specific context. The benchmarks for sustainability in high-income countries needs to be higher compared to low-income countries. The nature of the impacts assessed is determined by the products life cycle itself as for wood-based products, the focus is on social sustainability in forest management. This further is specified for the geographic area where the resource is coming from, in this study Germany. This method triangulation should create a complete picture about socio-economic key issues in the context of an emerging wood-based bioeconomy and is the basis for the impact category development.

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Session 6

Social LCA by the Multiple Capital Model

Capacities S-LCA and Participative Score Matrix (P.S.M.)

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1. Context and scope

Assessing the impacts of local productive sectors development needs consideration of the production chain (goods or services) as a strategic territorial policy. Impact estimation requires specific measurement instruments can be provided by S-LCA based on capacities.

However, such a perspective, the question of the identification of local priorities as multi impact indicators remains. The participative collection of priorities (into categories and sub-categories) and their relative weights, allowing the characterisation of the value of results obtained from local development program, is already possible due to the existence of a method developed by the “Centre d’Etudes de Projets” (CEP) : the Participative Score Matrix.

Our ambition is to propose a new version of this instrument by combining our estimation of potential capacity changes as a measure of stakeholders’ impacts, with requirement for provision of participative local aims indicators. Thus, we could provide policy makers with a synthesis of results, in the form of a “capability score” to allow discussion and comparison of alternative options. This would then be a simple indicator gathering many estimations of qualitative and quantitative changes in affected stakeholders potential capacity.

2. Principles

General principle of S-LCA capacity

The principle of capacity S-LCA is to articulate a value chain analysis, with a multiple capital approach, retaining only five capital classes (technical, human, social and

institutional), but excluding natural capital, in order to measure capacity changes of stakeholders performance as affected by social business practices. It is not a behavioural performance of social or societal responsibility corporate measure, but an estimation of real or potential capacities stakeholders' impacts.

The aim is to provide indicators to measure the impact of corporate action (for each level of the production chain, for each type of actor and for each form of capital) on individual endowments as additional capacity operating transformation.

The nature of estimated impact In S-LCA capacity results from a systematic process to identify and estimate effective changes in stakeholders impacted potential capacity, due to the development of a production chain. From this point of view, the nature of complex context, and its role, are subject to special methodological reflection. A context is a situation characterized by a specific accumulation of different types of capital forms, at a given time (t) in a given location (y), for given actors (n). The advantage of this approach is to allow the combination, through a multi-capital development model, of identification and of evaluation of multi-stakeholder impacts requirements,.

In this process, we differentiate a marginal effect of potential capacity and an effect of real capacity. For example, in the case of training course, associated with production, it will be a potential capacity effects conditions indicator. The acquisition of knowledge (if any), becomes a potential capacity marginal possible effect. When marginal knowledge becomes a proven competence then it is a potential capacity marginal effective effect. Finally, the use of this competence, and its capacity to increase productivity or marginal production, will be a net marginal effect of real capacity.

From this point of view, a marginal real capacity effect is a wellbeing effect, which is not to be confused with a simple variation of income. A potential capacity marginal effective effect, however, does not become always a real productivity effect. To make this possible, some technical and institutional conditions must exist, such as provision of equipment, employee working conditions, or existence of relevant rules. Generally, S-LCA performance selected indicators, (in terms of human and social capital) are only potential capacity effects «conditions» indicators in capacities S-LCA, not potential capacity marginal effect and even less net marginal effect of real capacity.

The introduction of a multiple capital approach, in corporate micro accounting, allows the improvement of strategy design. This approach also renews the conditions of an expanded National Accounts (Aglietta, 2011). It's the same, for S-LCA, whose goal is to identify the consequences of additional production provision, in economic, human, social and institutional specific environment. Marginal transformation of the economic and social space is analyzed as a modification of its present and future conditions of sustainable development, that is to say, all of its production and accumulation capacities.

The implementation of S-LCA presents the following phases:

- Identification of classes and subclasses capital,
- Identification of potential capacity effects classes,
- Identification of potential capacity effects conditions indicators,
- Identification and collection of internal information,
- Identification and collection of external information,
- Diagnosis of effects of potential capacity variations,
- Estimated variations of potential capacity effects (effective or potential capacity marginal effects),
- Change analysis of potential capacity effects to real capacity effects.

On indicators, it is necessary to identify the main effects categories generated by each subclasses of capital. In this case, the context is the real relevant identification guide. We propose for selected subclasses capital, categories of effects generally expected of action concerned by this type of capital (for all classes of capital: Garrabé et al., 2013 and H. Yildirim, 2013). It is a set of generic categories, which can be discussed and validated by a control group of actors and organizations. These categories may also change over time to reflect societal priorities.

Data gathered by an INTERNAL survey (in the company) allow the identification of actions performed but not their impacts. How these actions become impacts, requires multiple detailed information from different actors, who are being study. Given the difficulty of obtaining this information, we choose to use:

- additional ad hoc surveys,
- external available studies (local or transferable data),
- as well as expert interviews. The use of expertise may be needed at both the collection of information and the interpretation of results.

The objective of an EXTERNAL survey allowing comparable internal information quality is not sufficient to decide on a capacity marginal potential variation of impacted stakeholders.

That explains the potential capacity variation as an interaction between «social» actions of the company and the multi-stakeholders context impacted.

Principle of Multiple Capital Participative (M.C.P.) Score Matrix

The aim of a Matrix Score is the need to have a participative tool for measuring local action impacts. It allows to taking into account the relative weight of different actors priorities. It looks like a table with three reading levels and two levels of participation. Participation between technical experts who hold expertise and political actors, social values keepers, aims to take into account different conceptions about the same question. Each member is required to play a clearly previously defined role.

Political actors define the framework within which the project will be evaluated. This framework is based on the definition and weighting of criteria and sub-criteria:

- By construction, criteria are predefined and correspond to a specific form of capital. In this hierarchy, the function of elected officials is to assign a political value to each form of capital, on condition that the sum of the weights for each form of capital must equal 100%.
- The choice of sub-criteria belongs to politicians, even if they must rely on technical stakeholders to ensure the existence of these items. The central role of politicians is to assign a weight to each criterion in knowing that, for each item, the sum of the weights must equal 100%.

Technical actors must determine, factually and rationally, quantitative estimation of values for actor's sub criteria chosen by political stakeholders. This expertise must mobilize competent human resources and adequate technical resources. By the nature of the multi criteria Score Matrix, information can be monetary or technical. The observed values are indicated on a rating scale, initially defined by technical operators. The scale used is specific to each sub criterion. For each of these scales, acceptable values can be positive, negative or zero.

Expertise leads to a restatement of the gross rating obtained. First, it is necessary to define an equivalent value of the raw score, to insert the latter to a 0 to 100 units scale. Each adjusted mark on a 100 base is, then, multiplied by the associated weighting in policy sub criterion. Finally, for each criterion, ie for each selected type of capital, the criterion value is obtained by adding up the weighted sub criteria values. Ultimately, we get the value of the weighted criterion, by multiplying the value of the criterion by its political weight. The third level of reading the score matrix is the final score for the project studied. The score is the sum of the values of the five weighted criteria. By construction, this score is always between 0 and 100. Particularity of this score is to take account both of political weight and of technical expertise of all stakeholders who have to decide on the acceptability of the project.

Development of a Score Matrix requires a detailed inventory of each capital type sub-criteria. The selected components can be provided from either technical expertise of technical actors or values supported by politicians, or even, as a result of a mix between these two sources. It is very important that the selected sub-criteria are subject to consensus among all stakeholders to ensure the acceptability and quality of the analysis. Mostly, this work presents no particular problem, because the definition of each type of capital is quite explicit. Selected sub criteria are components which contribute significantly to each different form of capital identity.

The Score Matrix allows the determination of the project contribution by measuring the difference between the score with and without the project. This technique also allows estimating the positive real effect of the project by comparing the value of the estimate and the value of the project score. The higher the ratio $\Delta \text{ rating} / \text{score}$, the more the contribution the project compared to the baseline is important.

In both cases, the score matrix is a tool of knowledge production for the organization that implements it. Indeed, after making the early measurements, it is possible to follow in real time the effects of the project and compare them with initial estimates. These feedbacks increase the technicians and policy makers' knowledge of problems area, and puts the organization that leads it, in a continuous improvement participative dynamic position.

Capacities S-LCA et P.S.M. articulation

The aim here is to translate the results of a capacities S-LCA, in a decision tool to estimate relative (multi-actor and multi-capital) qualitative and quantitative impacts, of a local development project on different levels of an existing local chain of activities, taking into account multiple objectives and different priorities

From a project development within an existing local chain of activities, a capacities S-LCA is performed according to the protocol (See § "The implementation of S-LCA presents the following phases"), to assess its efficiency in terms of impacts on multi-actor and multi capital (compared to another project or relative to doing nothing). Changes in capacity of different actors affected, estimated by specific capacities S-LCA indicators (Garabé et al., 2013), are then translated as scores, estimating the overall importance of capacity changes, by level of subclasses capital.

Because logics of actors are expressed by priorities and different weights objectives, each subclass of capital is affected by specific coefficients (as we mentioned in Section 3). Scores of capacity variations can be calibrated from 1 to n, depending on the level of accuracy. It is not necessary that these scores are the same for all subclasses of capital. The readability of the matrix, but also the quality of the mobilized information, required for high value of n, that are usually, the value is between 5 and 10.

Scoring is always a delicate phase in an available information translation-reduction methodology. This phase of the method must be performed by an expert. All others phases involve policymakers or calculation spreadsheet. In the capacity LCA-S, around one hundred categories of potential capacity possible variations is estimated, which indicators are mixed (qualitative / quantitative, monetary / no monetary, etc.). This information is then grouped in a table in which each cell displays the estimated total, readability of the table being ensured by the use of a color process (Régnier abacus). The capacities score (See § "Political actors" and "Technical actors") is usually 6X9 matrix. It must therefore concentrate the available information without degrading it.

Classes of capital (A)	Share of capital classes (B)	Subclasses of capital (C)	Weighting of subclasses (D)	Score (1...n) of capacities change (E)	Values of capacities change (F)	Capacities weighting values (G)	Total values of capacities (H)	Capacities change value of weighting classes (I)
	Decision makers	Decision makers	Decision makers	Site investigations	Estimate (E/nx100)	Estimate (FxD)	Estimate (Total G)	Estimate (HxB)
Human	40%	Training	15%	2	40	6	36	14.4
		Working conditions	25%	-2	-40	-10		
		Health	20%	3	60	12		
		Security	20%	3	60	12		
Technical	20%	Parity (men/women)	20%	4	80	16	74	14.8
		Companies	30%	5	100	30		
		Infrastructure	15%	3	60	9		
		Information	15%	3	60	9		
Financial	15%	Market	25%	4	80	20	40	6
		Public administrations	15%	2	40	6		
		Grant	20%	2	40	8		
		Equity	20%	2	40	8		
Social	15%	Investment	20%	1	20	4	25	3.75
		Credit	20%	3	60	12		
		Induced effects	20%	2	40	8		
		Justice	30%	1	20	6		
Institutional	10%	Participation	30%	1	20	6	44	4.4
		Confidence / trust	15%	1	20	3		
		Social integration	15%	2	40	6		
		Social networks	10%	2	40	4		
		Property / ownership	20%	2	40	8		
		Competition	20%	3	60	12		
		Contracts / agreements	20%	1	20	4		
		Social dispute	20%	2	40	8		
		Norms / labelling	20%	3	60	12		
SCORE OF CAPACITIES CHANGE: between -100 and +100								
								43.35

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Implementing the MCM in social LCA

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1. Context and scope

The culture of assessment is growing within both public and private organisations. There are several reasons driving decision makers to determine, ex-ante or ex-post, the effects and impacts of the projects they are leading. The notion of performance is gradually being replaced by the notions of short and medium-term effects, and long-term impacts. LCA paved the way, by providing a standardised comprehensive method for assessing the environmental consequences of projects, programmes and public & private policies, when they affect product or service industries. The work conducted in this area for the past decade is now changing the perception of the decision makers, through mandatory consideration of the following points: designing the product or service for its entire life cycle, taking into account the stakeholders in developing a strategy, avoiding impact transfers between links in the chain, clearly explaining the objectives pursued and the scope under study...

This need for expanded assessment has extended to all dimensions of sustainable development. There are a wide variety of reasons for this. In no particular order, we can mention: the quest for increased economic efficiency, increasing awareness of the social effects of human activities worldwide, a necessary reassurance to customers and stakeholders as to their consumption habits and production conditions... This quest for stringency and transparency can be observed in the private sector, as well as the public and non-governmental sectors.

True, there are still substantial needs for communication, as a matter of priority, and the threat of “Green” or “Social washing” are still looms. Despite this temptation, we have to recognise that the marker for the requirements, and therefore the objectives, is gradually moving toward the need to assess the reality of the impacts caused by a project. So naturally we are moving from a performance culture to an impact culture. No longer is it the euro spent which counts, but how it translates into “impact of corporate action (for each category of player and for each category of capital) on the transformation of individual endowments into additional operating capacities” (Garrabé et al., 2013). The author at this point recalls two concepts which will underpin the methodology that we implement in the field to assess the impact of production

of a marginal product or service on society and individuals. Feschet and Garrabé suggested giving Social LCA a theoretical framework (Feschet et al., 2013) combining a multiple capital model (e.g. Stiglitz et al., 2009), and capabilities (Sen, 1993). It is within this theoretical framework that the capacities Social LCA is proposed and implemented.

2. Main text

The issue of capacities Social LCA, as for any other methodology, is to define and put together indicators able to measure the impact of an organisation's action. Garrabé suggests adopting as the various classes of capital: human, technical, financial, social and institutional capital, to which we might add natural capital. Along with other authors (Rodrik, 2000), Garrabé believes that certain capital sub-classes must be assessed. In this case we must identify the main categories of effects that each of the sub-classes might generate, all things otherwise being equal.

Contextualisation

Contextualising means having to go beyond ordinary technical, economic and financial analysis, to take into account the geographic, historical and social factors specific to the area under study. The role of the stakeholders is central, since they are the custodians of these specificities. Through consultation of these essential players of economic and social development with the project sponsor, their “objects to protect” or “objects to develop” can be jointly defined. Consideration and comparison of the values systems of each stakeholder makes it possible to define the project's reference value system. We might think of health, which is often a value common to all groups of players. Education is also part of the common foundation. Many other values may similarly be taken into account: equality, security, justice, certain cultures, etc. Here we are putting our finger on the problem of governance of this sort of assessment. Taking this into consideration from the initial stages means “linking the implementation of sustainable development to the conditions of governance under which it operates” (Rey-Valette, 2010). The author goes even further in demonstrating that there is no appropriation of sustainable development without governance involving the stakeholders at all levels.

The tool does not make the assessment

The choice of tool must come in the second stage of the assessment approach. The trend is actually to use a tool in which the assessment teams are proficient, and matching the field and the assessment issue. This malpractice automatically leads to questionable results. While Social LCA is a general concept, it is completely open as to the assessment tools to employ. We might use conventional tools such as calculating direct and indirect added value, or much more elaborate modelling and forecasting

tools, such as the cause-effect relations based on complex econometric models. The example of the Preston pathway, which links economic activity to the life expectancy of a population, is a very good example (Feschet et al., 2012).

Governance or role of the sponsor

The study sponsor is fully involved in the process of choosing the effects to study, but does not monopolise this role. In the latter scenario, it would be placed in the middle of the circle of industry stakeholders (desire to control the industry), or outside it (desire to relieve itself of responsibility), whereas it should be on the circle, along with all the stakeholders (figure 1).

There are various types of studies (ad hoc, second party, third party, etc.). Two specific cases lend themselves to conducting a Social LCA:

- several linked parties (by a contract, by membership of a union or professional body, by geographic production zone, by a common stake, etc.) decide to conduct an assessment on the effects of an organisational or technical change, on a new project, etc.
- the sponsor is one of the industry stakeholders (dominant firm, regulating body, rival to the dominant firm, etc.), but accepts the principle that it is just one of the factors to take into account, and that the success of the study will be dependent on the other parties taking part, in a democratic process.

In every case, the conditions for success are that it is eminently open and collaborative. In the best case scenario, the adopted solution will be all the more accepted by all of the players since they will have taken part in its assessment.

Scope

Experience acquired in the field shows that it is illusory to aim to conduct an exhaustive study such as a Capacities Social LCA throughout the product life cycle. In the vast majority of cases, the resources (financial and time) allocated to the study are by their nature limited. Even when the resources are available, we saw in the paragraph above that there is no any relevant social assessment unless it relates to the wellbeing of the persons concerned (Macombe, 2013).

So it is the binomial “target group” x “impact category” that will be needed to reduce and determine the scope of the study (geographic, institutional, economic, social, etc.). There also needs to be an overview of the industry. So the industry approach (stakeholders, flow analysis, financial relationships, operational relationships, etc.) is essential in order to define the social life cycle, which is “the system of interacting organisations, whose social behaviour depends on the existence of the product under study, and causes substantial social effects.” (Macombe, 2013).

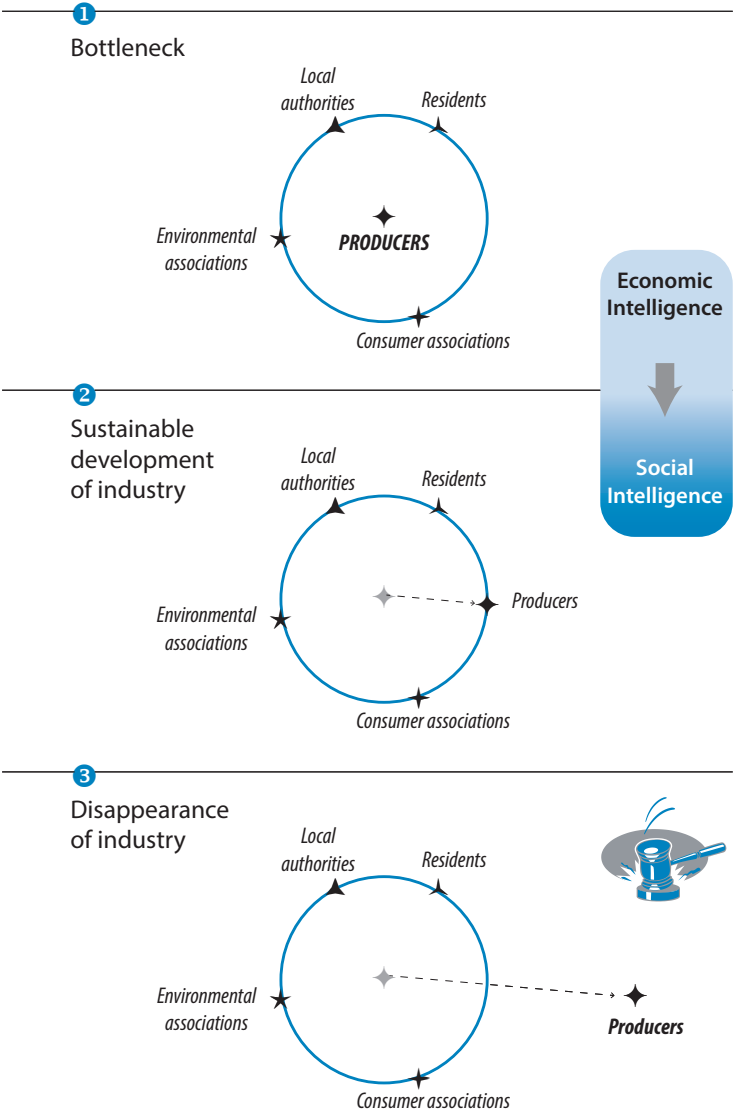


Figure 1: Producer's role in the strategic domain, and effect on industry development (sources: C. Gillet, D. Loeillet, M. Garrabé)

The example of the export banana industry is interesting from this viewpoint. The product has a long and complex life cycle. It develops over 10,000 km (between production and consumption), involves a host of processes (production, transport, packing, ripening, etc.), consumes large amounts of inputs and very heavily affects its natural and social environment. So it is difficult to achieve a social assessment for the complete life cycle of this product. It is by industry analysis, with the support of the stakeholders, that we have been able to identify the dominant forms of organisation (those which can change things), and the weakest stakeholders (those for which something needs to change). For the banana, this identification has been made thanks to a group comprising a highly representative set of industry players, the World Banana Forum. The conventional industry analysis work (especially breakdown of value), and the discussions within the Forum, have made it possible to identify the farm workers, small producers and their families as at-risk groups, due to their large number in the industry, their insecurity in terms of revenue (and low added value capture), working and living conditions.

Assessment issue

The subject of study of a Social LCA may be defined only once the initial problem has been contextualised and discussed with the stakeholders. These initial exchanges make it possible to very quickly identify the constraints, stakes and complexity associated with the operation of the industry. This work often leads to the study being specified and focused on a more realistic target. Too often, the issue is defined in general terms without initial consultation. These situations lead to bottlenecks or difficulties accessing information, which greatly limit the usefulness and scope of the results.

Functional unit

In principle, setting out to reveal a link between a product or a service and its socio-economic effects and impacts is a tall order. However this requirement is a specificity of the life cycle analysis. This point is often approached based on the product sold to the end consumer. This apparently logical approach is not always relevant, since in certain cases, the functional unit quite simply does not exist for all of the industry players. Example: 1 kg of bananas or 1 kg of meat (pork or beef): in the case of the banana, practically all the industry players see the finished product and base their strategy on the finished product; in the case of the meat, only the customer and the industry downstream see the finished product; all the other players (upstream, production) work on distinct units of measurement (carcass, adult animal, birth, juvenile animal). In the case of the banana, there is direct continuity between the production function and the functional unit. In the case of meat, there is no continuity. This discontinuity poses real allocation problems. The hypotheses used to factor continuity of the unit into the life cycle introduce more or less serious biases into the results.

These remarks and these limits are especially important if there are by-products associated with the functional unit.

Scoring

Use of a scoring method such as the Score® matrix (Gillet, 2014) developed by the Centre for Project Studies (CEP, Montpellier) entails open and transparent interaction with all the stakeholders involved. Assigning a value to the indicators via the method linking MCM and Capacities requires active participation of the stakeholders in the choice and weighting of the capitals and sub-capitals adopted for impact measurement. By virtue of its structure, the Score matrix compares and articulates a technical assessment (via MCM-Capacities) in a system of values (via the stakeholders involved). The results for the various projects (scores) round off the assessment process, supporting the stakeholders to the end: the decision.

Information

The lessons drawn from previous studies show us that there is always a big challenge around information access. It is one of the recurrent limits of all social assessments. Access may be impeded by certain stakeholders (who want to take advantage of the information dissymmetry) or may be non-existent (case of under-studied industries, or in countries with a deficient statistics gathering system). In every case, the issue of heterogeneity of information quality, and therefore validity, arises (Garraabé, 2013).

In project assessment mode

Finally, it is important to recall that any assessment is contingent on a specific context (economic, social and environmental) and a specific time frame. So it is extremely tricky to compare two projects not developing in the same context. Going back to our example of the banana, comparing the situation of workers on big plantations in Costa Rica to the situation of small producers in the Dominican Republic makes no sense, so different are the parameters and initial context. However, we might compare the “social difference” of a production extension project in Costa Rica with that of an extension project planned in the Dominican Republic. In this case we would retain the relativity of the effects associated with a definite context, rather than venturing into comparison, by absolute value, of the social footprint of two contextually distant organisations.

Conclusions

By virtue its nature, the assessment of social and non-biophysical processes, the Social LCA is highly complex, since it seeks to assess impacts via a wide variety of methods. To this end it implements a large number of methods, from the most conventional to the most pioneering. While the conceptual and methodological framework applies to

the whole life cycle of a product, in reality, it is very difficult to successfully complete a multi-criteria assessment over the entire process. So we will use methods to reduce both the groups, but also the effects to be studied. Finally, we will constantly guard against de-contextualisation of the results, which would make us assess hypothetical effects (values with no specific reference system), while all the effects are linked to a definite territory, organisation and time frame.

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Evaluation de la durabilité sociale de la filière des agrocarburants en Afrique suivant la perspective cycle de vie et à l'aide d'une utilisation combinée de méthodes

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1. Contexte et problématique

Les activités humaines ne sont pas sans incidence sur l'environnement et sur les populations. Aussi les préoccupations pour leurs impacts et la nécessité de leur évaluation ont-elles été formalisées en 1969 par la National Environmental Policy Act aux États-Unis (Burdge et Vanclay, 1996 :62). Depuis lors, plusieurs outils ont été développés pour permettre une meilleure prise de décision et une meilleure gouvernance du développement durable. Mais, ces outils présentent des divergences en lien avec leur champ d'application, leur méthodologie ou leur objet. L'analyse du cycle de vie (ACV) destinée à évaluer les impacts environnementaux d'un produit est classée parmi les outils d'évaluation environnementale (Revéret, 2011). À sa suite, l'Analyse sociale du cycle de vie (ASCV) a été développée et destinée à l'évaluation des impacts sociaux. Cependant, la dimension sociale du développement durable (DD) semble la moins avancée du point de vue de l'évolution des outils, alors que l'Homme demeure la finalité. En effet les modifications des écosystèmes se répercutent sur les populations humaines (Burdge et Vanclay, 1996) tout comme les valeurs culturelles et les croyances incitent les individus à utiliser l'environnement d'une manière particulière (Taylor et al. 1995 :48). Ainsi donc, les interactions issues des connections entre les dimensions (sociale, culturelle, économique, environnementale et de gouvernance) du DD ne sont pas sans conséquences sur le bien-être et soulignent l'intérêt d'évaluer, au-delà des impacts dans chaque dimension, le résultat de ces interconnexions dans une perspective de soutenabilité.

Le présent travail s'intéresse aux impacts de la production d'agrocarburants, produit à partir de ressources agricoles, sur le bien-être des individus. Ils sont présentés comme une alternative aux combustibles fossiles et soutenus par un intérêt politique dans un contexte où le « verdissement de l'économie » est proposé comme solution pour un meilleur développement. Dans les pays riches, la consommation en « carburant vert » s'accroît et crée une forte demande (Dutorme, 2011) qui les pousse à se tourner vers le Sud pour garantir leur approvisionnement en matières premières nécessaires. Plusieurs pays en développement se lancent ainsi dans la course avec des motivations

d'ordres économique et énergétique (Polet, 2011). Alors que certains soutiennent que les agrocarburants peuvent contribuer au déclenchement d'un processus original d'industrialisation (Matthews, 2007), offrir une opportunité de développement du secteur agricole et un accès à des énergies abordables (World Bank-ESMAP, 2005; Maltsoglou and Khwaja, 2010), d'autres s'y opposent en raison des incertitudes pour les populations et l'écosystème (Grain, 2013; Ziegler, 2011; Houtart, 2009). D'où la question de savoir comment et à quelles conditions le développement des agrocarburants pourrait constituer une stratégie de développement durable des pays du Sud. Pour y répondre, l'étude s'appuie sur la perspective cycle de vie et l'approche par les capacités d'Amartya Sen. Dans cette démarche, l'ASCV sera utilisée pour l'examen des étapes du cycle de vie, associée à l'évaluation socio-économique (ESE), en vue de faire des comparaisons et d'apporter des informations additionnelles. Le bien-être étant lié à l'ensemble des dimensions du DD, une évaluation de la durabilité sera réalisée en utilisant des données complémentaires provenant de l'ACVe et de l'EES. La présentation de la démarche méthodologique adoptée dans les pages qui suivent sera structurée en deux parties : la première donne un aperçu du cadre théorique et des concepts clés utilisés et la deuxième présente l'application des concepts et l'utilisation des outils sélectionnés.

2. Démarche méthodologique

A. Cadre théorique et conceptuel

L'énergie est indispensable au développement, car son accès favorise la création d'entreprises, l'amélioration du revenu et la sécurité alimentaire par l'amélioration de la production et du stockage (Diop et coll., 2013 : 5). Des études ont montré une relation entre l'accès à l'énergie et le PNB, le taux d'alphabétisation, la mortalité infantile et la fécondité (Sylvain, 2008; Jones and Thompson, 1996). L'énergie et le développement sont donc intimement liés et les enjeux de l'un sont aussi ceux de l'autre (Houtart, 2009). Souvent au centre des problèmes environnementaux, économiques, sociaux et géopolitiques, la question de l'énergie demeure un enjeu complexe qui entraîne la recherche de solutions de remplacement aux énergies fossiles (polluantes, non renouvelables et sujets à des flambées constantes de prix). Les agrocarburants, à cause des possibilités de remplacement qu'ils offrent, font l'objet d'intérêt depuis les années 2000 (leur production a été multipliée par 5,5 entre 2000 et 2009 (Polet, 2011)), mais ils sont au carrefour d'intérêts locaux, nationaux et internationaux et peuvent mettre en jeu le développement des pays du Sud. Couramment perçu comme une dynamique de progrès, le développement revêt plusieurs connotations selon les disciplines. En sciences sociales, le développement s'intéresse au contexte social, culturel et psychologique (Balandier, 1957) et étudie les rapports sociaux et les changements qui s'opèrent en lien avec les transformations économiques.

Pourtant au début le concept de développement avait seulement une connotation économique. Les premières définitions étaient alors basées sur les mesures de la croissance économique et le développement conçu comme une amélioration des conditions économiques des pauvres (Moss, 2007 : 2). Cette vision évoluera pour prendre en compte différents éléments dont ceux relatifs à la qualité de vie, avec les travaux de Sen (1993). Dorénavant, le développement est le fait de donner les possibilités aux individus de vivre selon leurs valeurs et de leur donner les moyens de devenir acteurs de leur propre destinée. Il est dès lors compris comme un processus qui dispose et favorise l'émancipation des individus avec pour finalité le bien-être. Toutefois, le bien-être des individus dépend de la synergie entre croissance économique, développement social et meilleure protection de l'environnement. Dans ce cas il est indiqué de s'assurer de la durabilité en veillant à favoriser un état d'harmonie entre les êtres humains et entre l'Homme et la nature (CMED, 1988).

L'intérêt croissant pour l'environnement impose au développement la dimension écologique et conduit à l'adoption d'un concept multidimensionnel, celui du développement durable. À travers leurs interactions, les différentes sphères qui représentent ces dimensions du DD s'influencent mutuellement et expliquent que toute variation dans le temps d'une, entraîne la variation dans le temps d'une ou plusieurs autres. Cela justifie ainsi l'intérêt d'une analyse intégrée pour mieux comprendre les incidences de la connexion entre les sphères. En effet, les différentes variations indiquées plus haut peuvent entraîner des changements en faveur ou en défaveur du bien-être des individus suivant qu'elles leur permettent d'accroître leurs capacités ou sources de risques. Lorsque les changements induits sont positifs, ils peuvent contribuer à une hausse des capacités et à une diminution de la vulnérabilité, situation favorisant une évolution vers le bien-être. Par contre, lorsque les variations sont négatives, elles peuvent conduire à une multiplication des risques et se traduire par une plus grande vulnérabilité. Ainsi « Vulnérabilité = Risque / capacités » (Ollierou R. et B. Quantinet, 2004).

Le bien-être, adopté en termes de qualité de vie, est au cœur du développement durable en référence à la définition qui le présente comme « le fait d'améliorer les conditions d'existence des communautés humaines tout en restant dans les limites de la capacité de charge des écosystèmes » (UICN, PNUE, FMN, WWF, 1991 :9). De ce fait, parmi les approches applicables au développement durable, nous adoptons celle découlant des travaux sur les capacités (Sen, 1981) parce qu'elle nous paraît mieux adaptée à la compréhension du développement comme l'accroissement du bien-être des humains d'aujourd'hui et de demain (Boulanger, 2004). Le concept de durabilité traduit ainsi la nécessité de veiller à ce que le niveau de bien-être ne décroisse pas dans le temps pour les générations successives (Ferrari, 2010). Le développement se présente en ce moment comme une extension des capacités de tous. Les capacités d'une personne, étant constituées autant de ses capacités que de ses potentialités, s'expriment par le fait que la personne, à partir de ressources accessibles, réalise quelque chose (Doing) ou peut atteindre un certain état (Being) (Sen, 1999 : 82).

B. L'application de l'approche par les capacités

Dans le cadre de cette étude, mesurer l'impact des agrocarburants sur le bien-être reviendrait à évaluer les changements qui affectent la vie des individus. Puisque les changements proviennent des interactions entre les différentes sphères, l'analyse se penchera sur l'évaluation des capacités qu'offrent les agrocarburants et les risques provoqués en rapport avec les dimensions du développement. Dans les pays sous étude, les dimensions affectées par la production des agrocarburants sont : l'économie, le social, le culturel, l'environnement et la gouvernance (figures 1 et 2). Pour ce qui concerne l'évaluation des capacités engendrées, la démarche concernera l'évaluation des potentialités créées et l'identification des capacités réellement acquises par les communautés. S'agissant de l'évaluation des potentialités, une étude sur les possibilités de dotations en capitaux sera réalisée en identifiant les différents capitaux auxquels font appel la production des agrocarburants et ceux rendus disponibles aux communautés à travers le développement de la filière.

Pour analyser les capacités réelles existantes et les risques encourus, l'ASCV et l'ESE seront mises à contribution. L'ASCV permettra de définir le système et les parties prenantes impliquées dans la production des agrocarburants. Sept étapes ont été identifiées dans le cycle de vie des agrocarburants (allocation ou achat des terres, acquisition des ressources nécessaires aux travaux champêtres, le travail au champ, le transport de la biomasse, la transformation et la consommation) ; toutefois l'analyse ne sera déployée que sur les quatre premières phases, étant donné que la transformation et la vente sont parfois réalisées dans d'autres pays. Dans cette portion du cycle de vie à étudier, les parties prenantes identifiées sont : les propriétaires terriens, les autorités locales, les universités/chercheurs, les ONG, les producteurs, les acheteurs des matières premières, les industries, les fournisseurs et les consommateurs. En partant des dimensions affectées par les agrocarburants, de grands enjeux à prendre en compte dans les catégories d'impacts sont identifiés et sont une adaptation qui combine des éléments proposés par le guide ASCV du PNUE/SETAC (2009) et des informations relatives aux composantes retenues en se référant aux sous-classes de capitaux dans la méthode de l'ACV sociale des capacités (Macombe et al., 2013). Ainsi prédéfinies, les composantes retenues serviront de point de départ et seront validées par des experts sur le terrain afin de finaliser l'élaboration des indicateurs destinés à la collecte des données.

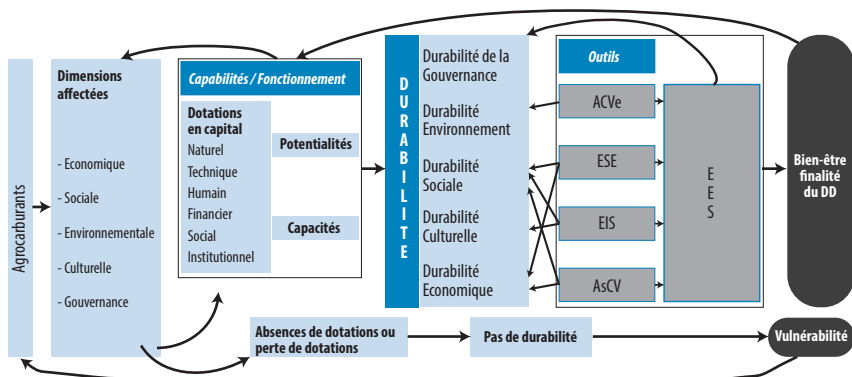


Figure 1 : Influence des agrocarburants sur le bien-être (adaptée de Sourisseau et al., 2012)

L'étape suivante consiste en la définition des grandes composantes de l'étude.

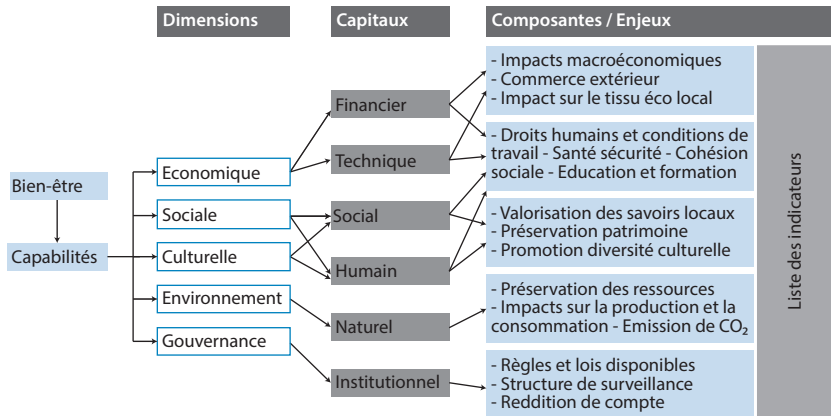


Figure 2 : Décomposition des éléments du concept (Auteure, 2014)

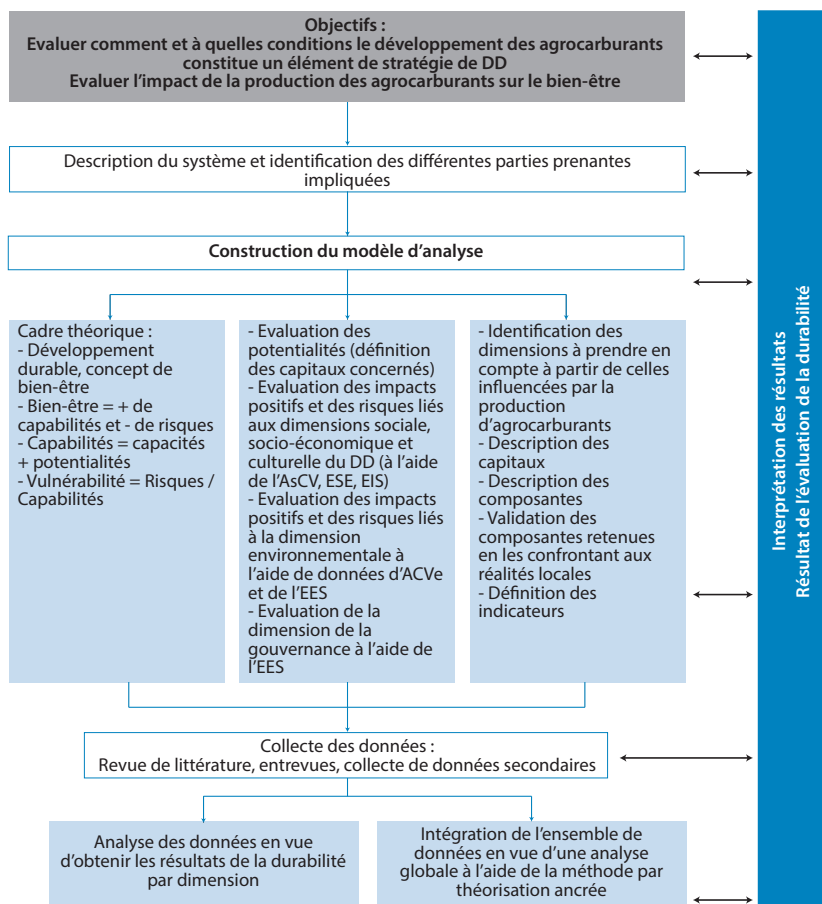


Figure 3 : Schématisation des étapes de l'analyse

En complément, l'analyse de la durabilité envisagée fait appel à l'ACVe et à l'EES. En s'outillant d'une grille de collecte et d'analyse des données, les impacts environnementaux seront collectés à partir d'ACVe sur les agrocarburants et d'EES. Pour les informations relatives à la gouvernance, les données seront recueillies lors de la collecte relative à chaque dimension et aussi à travers des rapports d'EES. Lorsque tous les éléments nécessaires auront été recueillis, l'EES, outil qui comprend dans sa démarche des étapes d'analyse des impacts liés aux différentes dimensions du DD, servira de cadre d'analyse pour l'ensemble du travail et à l'étude de la durabilité de la filière. Une analyse séparée fera ressortir les impacts qui se rattachent à chaque

dimension. L'ensemble des données sera ensuite agrégé en vue d'une analyse globale à l'aide de la méthode de la théorisation enracinée et pourrait induire l'émergence de nouvelles informations enrichissantes pour l'étude. Les différents outils choisis pour ce travail ont été retenus parce qu'ils ont chacun avec les autres outils mis à contribution des points de convergence dans leurs étapes respectives. Le but de notre travail est d'utiliser différents outils en vue de croiser les informations et de nous donner plus de latitude dans la collecte de données pertinentes. La démarche que nous venons de présenter nous donne un aperçu sur les possibilités d'arrimage entre les différents outils d'aide à la décision utilisés dans le cadre de l'évaluation du développement durable. Plus spécifiquement, elle laisse entrevoir comment, à l'aide des données et des informations collectées dans le cadre d'autres outils, une évaluation de la soutenabilité pourrait être réalisée. Cependant, la réflexion se poursuit et toute contribution pourrait donc contribuer à la bonifier.

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Comparison of the results of social life cycle analysis of capacities for the two turkish processed tomato sectors

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1. Introduction

Today, thanks to the new mode of consumption, many people become aware of the fact that their consumption choices have important environmental, social and nutritional impacts. This gives rise to many questions related to Social Life Cycle Analysis (SCLA), a methodology that aims to estimate the socio-economic impacts along the life cycle of a product in order to encourage more sustainable production systems. It is in this context that we have developed our research.

In this research, we used a new methodology, Capacities-SCLA, which is developed by Montpellier University 1-Cirad-IAMM¹ in Montpellier. It is based on SCLA approach and aims to estimate potential impacts of the production activity on the different form of capital along the life cycle. A good quality of life, good health, a good job, social and legal institutions that work well, a wide range of environmental goods and services can all be considered as the key factors of the development process. These factors refer to the different form of capital: human capital, natural capital, technical capital, financial capital, social capital, institutional capital. In the Capacities-SCLA approach, we analyze social and socio-economic aspects of a product and estimate its potential impacts (positive or negative) along the life cycle. The positive impact on any capital class means that there is an increase in the capacity for the concerning actors. The term capacity is linked to the term "capability" used by Amartya Sen (1998 Nobel Prize winner in economics) in his research of development. The capacity in our approach refers to the "information translated in a homogenous manner in terms of increasing or diminishing capabilities" (Garrabé and Feschet, 2013, p 81).

It should be noted that the production and accumulation process of each type of capital are affected by the marginal change in social and environmental conditions. The Capacities-SCLA aims to estimate the impact and its nature using efficient indicators. Thus, our problematic is *«to construct indicators that measure corporate action (for each level of industry, for each category of actor and for each category of capital) on the transformation of endowments individual in additional operating capabilities»* (Garrabé and Feschet, 2013).

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In this research, we've tried to estimate the impacts of the production activity on the concerning actors using Capacities-SLCA indicators for the Turkish processed tomato sector (tomato paste and dried tomato). The results are presented according to the indicators of the five capital class: human capital, technical capital, financial capital, financial capital, social capital and institutional capital.

2. Application of the Capacities SLCA to the Turkish Processed Tomato

During the first stage of our research, we identified production zone and type of product. The research has been conducted in Izmir and Manisa, the two cities of Aegean Region in western Turkey where the tomato based industry is very important for region's economy. We've worked on the two main sectors of tomato: tomato paste sector and dried tomato sector.

The survey of our research is based on five capital classes and their sub-classes. Categories of Potential Effects of Capacity (PCE) and Indicators of Conditions of Potential Capacities Effects (ICPCE) are identified according to each type of capital². Table 1 illustrates the classes and sub-classes of capital of our research.

In the next stage, we identified the sources of internal and external information. The main sources for the collection of internal information are as follows:

- To contact various actors of the Turkish processed tomato sector
- To collect the quantitative and qualitative information related to the production of tomato and its industry
- To collaborate with research organizations to obtain more information about the sector
- To conduct interviews with 5 firms, 10 producers and 3 logistics companies in the Turkish tomato paste sector
- To conduct interviews with 5 firms, 10 producers and 2 logistics companies (same of the tomato paste sector) in the Turkish dried tomato sector

Table 1: Classes and sub-classes of capital

Human capital	Technical capital	Financial capital	Social capital	Institutional capital
Education (E)	Company (C)	Subsidies (Sbs)	Justice/fairness (Jus)	Rules of protection (RP)
Working conditions (WC)	Infrastructures (I)	Equities (Eq)	Participation (Pcp)	Rules of monitoring (RM)
Health (H)	Information (Info)	Saving (Sv)	Trust (T)	Rules of regulation (RR)
Security (Se)	Market (M)	Wages (W)	Integration&culture (IC)	Rules of coverage (RC)
Parity (P)	Administration (Adm)	Public funds (PuR)	Social Networks (SN)	Rules of arbitration (RA)
		Credits (Cr)		

² For more information related to methodology, refer to the study of Garrabé et Feschet (2013)

External information has been obtained from the sources below:

- Standards and regulations at sectoral level: Turkish processed tomato industry
- Standards and regulations at national level: Turkish law
- Standards and regulations at international level
- Research and papers, interview with workers, union (Tek-Gıda İs), experts (Agricultural Insurance Pool-Manisa), academics from Ege University
- Observation of researcher

3. Results of the study

3.1 General Situation

Firms in tomato paste sector

- Firms are located close to the places of culture.
- In general, they have individual contracts with producers. All stages of production (from planting to the harvest) are monitored by the agronomists of the company.
- 1 kg of tomato paste requires 5.8-6 kg of fresh tomato. Brix value of tomato paste is 28-30.

Firms in dried tomato sector

- Firms are located close to the places of culture. The majority of firms produce sun-dried tomato
- In general, they don't have individual contracts with producers.
- 1 kg of dried tomato requires 12-14 kg of fresh tomato.

Producers

- All producers surveyed in the tomato paste sector work under individual contract with firms. They give 80-85% of the quantity of tomato production to the company, and reserve the rest for the market and self consumption. Three out of ten producers have income apart from agriculture.
- The majority of producers surveyed in dried tomato sector do not work under individual contracts with firms. 20-30 % of the quantity of their tomato production is given to the company; the rest is reserved for the market and self consumption.
- All the producers have social security.

Logistics companies

- They are located in the center of Izmir. They practice maritime transportation.

Seasonal workers

- They come from eastern regions of Turkey. They travel in trucks.
- There is inequality between man and woman salary.
- They do not housing.

3.2 Scores of Capacities-SLCA for the Turkish Processed Tomato Sector

Figure 1 and 2 show some extracted results on capacities. The first two lines of the tables refer to the classes and sub-classes of capital mentioned in Section 2. The lines of P (P1, P4...) show the results obtained for the producers interviewed in two sectors. The next T lines (T or Ts) correspond to the firms interviewed in each sector. Finally the last lines in the tables (L1, L2, L3) refer to the results for the logistics companies.

	Human Capital					Technical Capital					Financial Capital					Social Capital					Institutional Capital						
	E	WC	H	Se	P	C	I	Info	M	Adm	Sbs	Eq	Sv	W	PuR	Cr	Jus	Pcp	T	IC	SN	RP	RM	RR	RC	RA	
P1	2+	4+	2+	0	0	3+	2+	0	0	0	4+	2+	0	0	1+	0	1+	0	2+	2+	1+	0	1+	0	2+	0	
P4	0	3+	2+	0	0	2+	2+	0	0	0	4+	0	0	0	1+	0	1+	0	2+	2+	1+	2+	1+	0	2+	0	
P6	0	2+	0	0	0	2+	2+	0	0	0	4+	0	0	0	1+	0	1+	0	2+	2+	1+	2+	0	0	2+	0	
T2	3+	8+	3+	5+	3+	4+	5+	7+	4+	5+	1+	3+	2+	2+	1+	2+	3+	2+	2+	2+	2+	3+	2+	6+	4+	2+	3+
T3	4+	12+	6+	3+	3+	7+	5+	7+	6+	2+	5+	6+	1+	3+	2+	4+	5+	6+	4+	3+	4+	8+	4+	3+	2+	3+	
T4	1+	3+	5+	2+	4+	5+	3+	9+	4+	2+	5+	1+	3+	6+	4+	1+	2+	4+	1+	2+	1+	4+	3+	1+	2+	2+	
L2	5+	10+	7+	3+	7+	10+	8+	4+	5+	2+	4+	6+	6+	0	2+	0	7+	4+	4+	1+	3+	5+	4+	2+	2+	4+	
L3	0	7+	3+	2+	3+	4+	2+	3+	2+	2+	2+	4+	4+	0	2+	0	4+	2+	4+	1+	3+	3+	2+	0	2+	3+	

Education

Infrastructure

No union,
no social dialogue

Figure 1: Variations of Effective Potential Capacity in Capital for Turkish Tomato Paste Sector (Source: Our Surveys, 2012)

	Human Capital					Technical Capital					Financial Capital					Social Capital					Institutional Capital						
	E	WC	H	Se	P	C	I	Info	M	Adm	Sbs	Eq	Sv	W	PuR	Cr	Jus	Pcp	T	IC	SN	RP	RM	RR	RC	RA	
P2	0	1+	1+	0	0	3+	0	0	0	0	3+	1+	0	0	1+	0	0	0	0	4+	1+	2+	1+	0	0	0	
P3	0	1+	1+	3+	0	3+	0	0	0	0	3+	1+	0	0	1+	2-	1+	0	1+	6+	0	2+	0	0	0	0	
Ts1	0	3+	2-	0	2+	1+	1-	6+	1+	0	2+	1+	2+	1+	3+	0	2+	0	2+	1+	2-	1+	1+	0	1+	2+	0
Ts3	1+	6+	1+	2+	1+	6+	3+	0	2+	1+	2+	2+	0	0	2+	0	3+	2-	2+	2+	2+	4+	2+	0	2+	1+	
Ts5	5+	8+	3+	3+	2+	8+	3+	1+	0	2+	2+	3+	4+	2+	2+	0	5+	1+	2-	4+	2+	4+	3+	3+	2+	1+	
L1	5+	10+	7+	5+	7+	10+	8+	8+	7+	2+	3+	6+	6+	2+	2+	3+	7+	6+	5+	4+	4+	7+	4+	2+	2+	4+	

Figure 2: Variations of Effective Potential Capacity in Capital for Turkish Dried Tomato Sector (Source: Our Surveys, 2013)

Increase in capacity: low level , average level , high level
 Decrease in capacity: low level , average level , high level
 Neutral: no impact on capacity

3.2.1 Some results concerning the producers

Human Capital: It is seen that there is a very low participation to the capacity for the sub-class “education” by the producers in both sectors. There is an increase in low level for the sub-classes “working conditions” and “health” in both. The hard working conditions of seasonal workers are considered “neutral” due to the exemption of the standards in national level. However, the impact is particularly negative for the seasonal workers according to the international standards. For the sub-class “parity”, the impact of the production activity is neutral in both sectors.

Technical Capital: For the sub-class “company” and “infrastructures”, there is an increase at low level for the majority of producers in the first table. For the producers in the second table, the impact on “company” is positive and there is no impact on “infrastructures”. The impact on the other sub-classes of technical capital is neutral for both sectors producers.

Financial Capital: It is the small amount of subsidies that create an impact relatively positive on the financial capital for both tables. Subsidies are considered as “capacitating” because input prices (oil, fertilizer, electricity) in Turkey are higher than those of other countries. We see that there is a neutral impact on sub-classes “saving” and “credits”.

Social Capital: The production activity has no impact on participation for both groups of producers.

Institutional Capital: For the majority in two tables, there is an increase of capacity at low level for the sub-classes “rules of protection” and “rules of monitoring”. However, the impact is neutral for “rules of regulation” and “rules of arbitration”.

3.2.2 Some results concerning the firms

Human capital: For the majority of the firms in the first table, there is an increase at average level in the capacity of sub-classes of human capital except for firm 2 and 4 with some negative impacts on “education” and “working conditions”. In table 2, we see that all firms create an increasing capacity except for firm 1 with negative impacts on “working conditions” and “parity”.

Technical capital: The impact is very positive on sub-class “company” especially for firms which have a great market share. For other sub-classes, the firms in table 1 create an increasing capacity at average level whereas those in the table 2 are creating a positive impact at low level.

Financial capital: It is the sub-class “equities” for which impact is the highest for financial capital in table 1. For other sub-classes, there is an increasing capacity at low level for the majority. In table 2, the impact on financial capital is quite low compared to table 1.

Social capital: In table 1, there is a positive impact on the sub-classes “justice” and “participation” especially for those that encourage unison's activity in the workplace. The impact on “participation” is negative for all firms in dried tomato sector.

Institutional capital: In table 1, there is an increasing capacity especially for the firms with a large market share. In table 2, we see that the overall impact on institutional capital is less positive. This is because the firms in tomato paste sector were founded a long time ago than those in dried tomato sector.

3.3.3 Some results concerning the logistics companies

Human capital: The logistics companies L1 and L2 create more increasing capacities along the life cycle. These are the firms with a great share in the logistics sector. For the third one, the impact is in general positive at average level.

Technical capital: The first company L1 has the more positive impact on the sub-classes “company”, “infrastructures”, “information” and “market”.

Financial capital: For the sub-classes “equities” and “saving”, there is an increasing capacity at high level for all firms. The impact is positive at low level for the other sub-classes.

Social capital: The overall impact on the social capital is positive for all companies. The impact is less positive on the sub-classes “integration and culture” and “social networks”.

Institutional capital: The companies L1 and L2 create more increasing capacities for institutional capital. The impact is less positive on the sub-classes “rules of regulation” and “rules of coverage”.

4. Conclusion

Our methodology aims to develop a new approach based on the relationship between SLCA and economic development theory. In this study, we tried to apply this methodology to Turkish processed tomato sector to identify the impacts in terms of capacities. This field study is important for the fact that it can be useful to determine the limits of Capacities-SLCA in order to improve it while proposing convenient remedies. Also, it allows us to see comparative results for the two sectors of Turkish processed tomato for each type of capital category and actor.

Reference

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Quelques réflexions sur la mise en oeuvre conjointe de l'évaluation environnementale et socio-économique du cycle de vie pour des produits agricoles

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1. Contexte et problématique

Les circuits courts de distribution des produits agricoles se développent. Afin de donner des clés de compréhension et d'amélioration de ces circuits aux acteurs locaux des filières, et en particulier aux producteurs, la Picardie a lancé une étude sur plusieurs produits agricoles frais locaux (pomme, pomme de terre, carotte et viande de porc). L'objectif de cette étude est de comparer plusieurs scénarios combinant des modes de production et de distribution différents. Dans l'optique de l'analyse de ces systèmes de production et de distribution, à la fois d'un point de vue environnemental et socio-économique, l'Analyse du Cycle de Vie environnementale (ACV) et l'Analyse socio-économique du cycle de vie (ACVS) ont été identifiées comme des méthodes pertinentes. Pour mettre en pratique l'ACVS, et fournir aux acteurs régionaux une aide à la décision factuelle et pertinente, l'évaluation sociale du cycle de vie des filières agricoles concernées a été choisie (Gillet et Loeillet, 2013). Cependant, la mise en œuvre conjointe de ces deux approches, bien que faisant appel à certaines notions proches, soulève plusieurs questions d'ordre méthodologique. Le présent texte discute de la mise en œuvre de l'unité fonctionnelle, du système étudié et de l'allocation pour ACV et ACVS en se basant sur l'expérience de l'évaluation de produits agricoles produits et vendus en circuits courts, en référence aux circuits longs, dans la région Picardie.

2. Texte principal

L'unité fonctionnelle (UF) correspond à la fonction assignée au système que l'on étudie, en ACV comme en ACVS. Cependant, son choix affecte les résultats de l'évaluation environnementale et socio-économique de manière différente. En effet, l'ACV s'attache à une grandeur physique, dans notre cas, deux UF expriment les résultats : 1 kilogramme de produit vendu dans son point de vente final (marché, ferme, AMAP ou supermarché), et la surface (en ha) utilisée pour produire ce kilogramme. Ces deux UF correspondent aux fonctions que l'on assigne implicitement

aux systèmes agricoles étudiés, ici : « produire un aliment qui est vendu dans divers circuits de distribution » et « entretenir l'espace ». Ainsi, une même analyse fournit conjointement ces deux points de vue différents sur le système étudié. Pour l'ACVS, qui étudie les moyens de production dédiés à un produit, agricole pour le cas présent, l'UF correspond à l'unité dans laquelle les résultats de l'évaluation sont exprimés. Cette UF se doit d'être cohérente avec celle de l'ACV pour l'évaluation conjointe des impacts environnementaux et socio-économiques d'un même système étudié. Ainsi, non seulement la grandeur physique de l'UF, mais aussi sa valeur sont à considérer dans la pratique de l'ACVS. Par exemple, un kg de pommes issu de deux hectares ne permettra pas les mêmes économies d'échelle qu'une production d'un kg de pommes provenant de plusieurs dizaines d'hectares. Le choix d'un système de production type, i.e. une exploitation agricole avec sa stratégie et sa taille économique propres est donc essentiel en parallèle de l'itinéraire technique type pour évaluer conjointement le même système avec l'ACV et l'ACVS. Les modalités de vente des produits agricoles frais pèsent dans les impacts environnementaux de l'ACV essentiellement via les distances et les modalités de transport de la marchandise (par exemple : optimisation du circuit de distribution, taux de remplissage du véhicule, adaptation du gabarit du véhicule à la quantité transportée, réfrigération du transport). Au-delà de ces caractéristiques, les prix de vente et les délais de paiement entre les différents maillons de la filière constituent les principaux points clés du circuit de distribution qui ont des conséquences directes sur les résultats de l'ACVS.

Les limites du système étudié doivent également être cohérentes entre les deux approches ACV et ACVS, mais les règles de coupures et les éléments considérés par l'une ou l'autre ne se basent pas sur les mêmes déterminants. En ACV, l'étude d'un produit se fait sur l'ensemble des éléments techniques nécessaires à sa production, et rejoint en cela la notion de filière de l'ACVS. Ainsi, pour évaluer les impacts environnementaux du porc nourri avec des aliments produits à la ferme, l'ACV considère et évalue les étapes de production des aliments à la ferme, et hors de celle-ci. De la même manière, l'ACVS cherche à modéliser l'amont des filières de production. Pour l'exemple du porc, il s'agit de distinguer les moyens dédiés strictement à la production de l'alimentation du porc. Une des difficultés de la mise en œuvre pratique de l'ACVS réside dans l'allocation spécifique des moyens de production amont, lorsque plusieurs produits (par exemple des porcs et des céréales) sont issus d'une même exploitation. Pratiquement, cette allocation peut se faire par les temps de travaux ou d'utilisation, spécifiques à la production du porc, de machines ou de bâtiments qui sont employés pour plusieurs activités de l'exploitation agricole. Pour ce qui est des intrants achetés hors de l'exploitation agricole, l'ACV modélise les flux environnementaux des filières de production correspondantes. Or, en ACVS, la modélisation de ces filières nécessite non seulement des données et ordres de grandeur techniques, mais aussi la compréhension des stratégies économiques des acteurs de l'amont agricole (producteurs d'aliments, d'animaux, fournisseurs), ainsi que les données socio-économiques correspondantes. Ainsi, si l'ACV peut se baser sur des données génériques pour modéliser l'amont des filières agricoles, l'ACVS ne peut s'affranchir de données primaires pour analyser puis évaluer leur fonctionnement. En pratique, la cohérence des limites du système étudié entre l'ACV et l'ACVS pour

évaluer un même système est donc peu aisée à maintenir. Dans l'exemple du porc en partie nourri avec des aliments de la ferme, le système étudié en ACVS n'a ainsi pas pu intégrer l'amont des filières de production des aliments.

L'évaluation d'un même système de production et de circuits de distribution agricole par l'ACV et l'ACVS n'est pas sensible aux mêmes déterminants. Lors de leur mise en œuvre, si certains points de vigilance sont communs, maintenir les deux analyses cohérentes se révèle un exercice peu aisé. Cependant, les deux approches conjointes permettent d'enrichir la compréhension du fonctionnement, l'analyse et l'évaluation des systèmes étudiés. Reste que la combinaison de ces deux méthodes permet, sur le terrain, d'apporter des éléments utiles à la prise de décision des acteurs des filières (producteurs, décideurs, conseillers). Cela leur permet soit d'orienter leur politique et les actions à mener, soit, par exemple, d'améliorer les systèmes qui ont été étudiés (en l'occurrence, la production et la distribution en Picardie), selon différents circuits, de produits agricoles non transformés.

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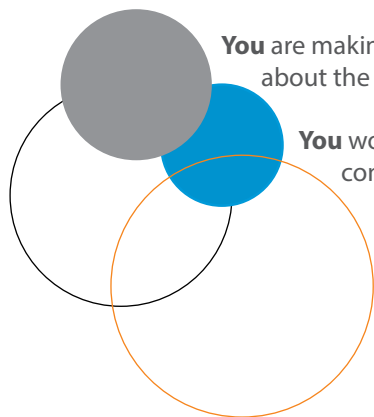
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